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OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

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October 3, 4, 5, 1933

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June 1933

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ONE had brought a new tungsten carbide die, rough nib, with copper wire drawn through it it measured .0365 and .0399.

✦ ✦ ✦

THE spindle of the machine is hollow, a piece of ¼ in. round cold rolled steel, tapered both ends, was passed down thru the spindle and held in a chuck on the spindle, the spindle and the die were tipped to the angle required, and using 280 grain boron carbide, the angle was clean in one minute, but because the straight hole for the bearing was about ⅛ in. long it took five minutes more to make the taper hole clear through the die.

✦ ✦ ✦

THE die then measured .0381—.0404, the tapered end of the rod was still smooth and worn very little.

✦ ✦ ✦

THEN the spindle and the die holder were set vertical, a piece of .040 dead soft brass wire was pulled through the die, then, still using the same boron carbide, the machine was run 2 minutes, the die measured .0415—.043.

THEN .045 dead soft brass wire was pulled through the die and the machine run one minute, die measured .047—.0473.

✦ ✦ ✦

THEN .051 dead soft brass wire was pulled through the die machine, run one minute and the die measured .0552—.0555.

✦ ✦ ✦

THEN .057 dead soft brass wire was pulled through the die and the machine run ½ minute and the die measured .0598—.060.

✦ ✦ ✦

THE grade of boron carbide was next to the finest made but the machine cuts so fast that only one grade is required, the surface left is so smooth that by repeating the operations, reversing the pointed rod and using No. 7 diamond dust and cutting about 3 minutes on the angle and about ½ minute on the bearing, the die is .063 and has a beautiful polish.

✦ ✦ ✦

THEN a piece of soft wire, a shoe string or anything flexible is held vertically in the two chucks, after having been pulled through the die, the wire revolves or not, as you please, the the die is tipped to polish the entrance and the die is fed toward the wire, in either direction, and the sharp edges are rounded off and the die is finished on the machine and no hand work used.

✦ ✦ ✦

THE machine using a shoe string and No. 7 diamond dust, while polishing a .114 die cut seven tenths in the bearing in six seconds.

✦ ✦ ✦

A die .235 was put into the die holder, this die had an internal gear in it from having been left in the wire machine too long, a piece of cold rolled steel placed in the chucks, vertically, the die tipped until the angle hit the rod and after starting the machine using same boron carbide, the die was fed toward the rod and after the angle was cut clear through the die, and the gear removed, the rod was examined and the surface of the three sixteenth rod was as smooth as the original rod and was reduced in diameter less than one thousandth.

THE machine with 280 boron carbide will cut a die ten thousandths a minute, has recut a .064 diamond one tenth a minute, using drill rod, cut in two, no pointed tools are required, the straight rod cuts the angles and the bearings equally well and fast, has been used down to .032 with a darning or knitting needle for a cutting rod.

✦ ✦ ✦

It does not tear the pointed tools, one pointed end will cut a new tungsten carbide nib clear through the die and still be smooth and show practically no wear as compared with the present practice.

✦ ✦ ✦

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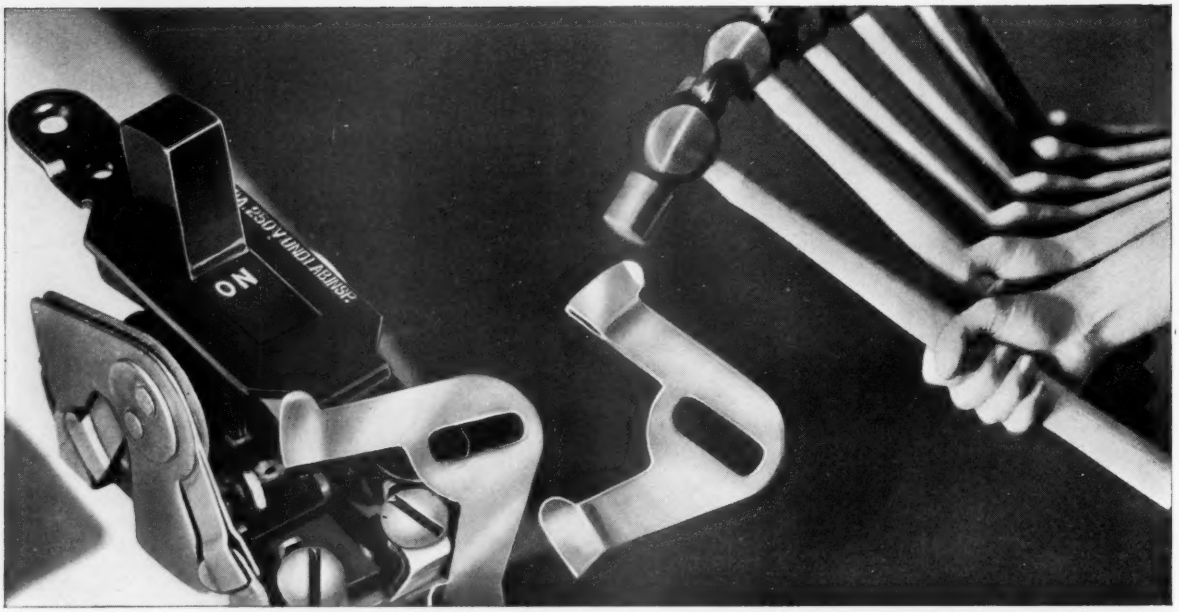

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WIRE & WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip. Wire Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING.

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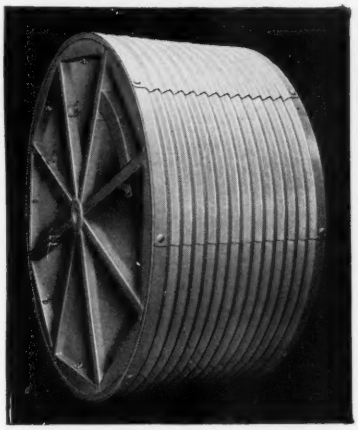

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Sleeper & Hartley TRADEMARK

TWO TRENDS

TWO advances of major importance to the Wire Industry have become apparent since the inauguration of President Roosevelt and the justly-famous New Deal.

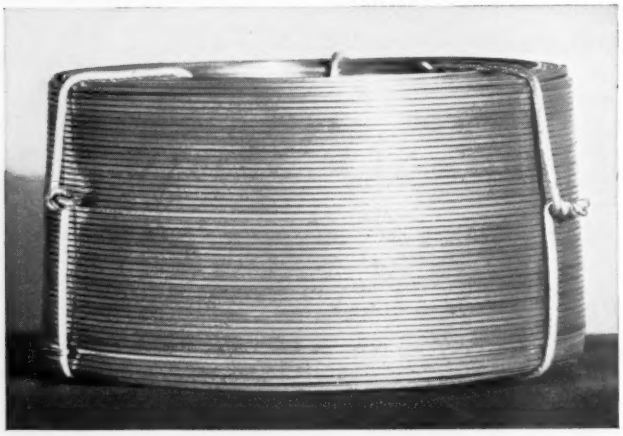
The first is that Business is definitely better. Not completely revived from its former unconscious condition but convalescent to the "thin gruel and light diet" stage.

The second is that there is a definite trend toward spooled wire in the better grades and special shapes.

That wire, wound as neatly and evenly as silk thread on a spool, is more easily handled and is less subject to waste by the ultimate consumer is generally acknowledged.

In keeping with this trend some of the larger wire mills have already installed Sleeper & Hartley spoolers and find that there is an increasing demand for their output. It will repay the wire mill executive to investigate the possibilities of these high-speed precision spoolers.

Buyers are asking for spooled wire and the Sleeper & Hartley spoolers, with capacities increased beyond any previous machines, gives the buyer what he wants.



Rectangular section wire spooled by a Worcester wire company at 2000 turns per minute on one of three Sleeper & Hartley machines supplied for the job.

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Wire Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 8 JUNE, 1933 No. 6

Galvanizing Fluxes

By W. H. Spowers, Jr.

Consulting Galvanizing Engineer

In this article the writer proposes to cover a very interesting development on galvanizing fluxes and the technique of their use which have occurred mainly in the past year.

THOSE of us who are concerned with this old process of galvanizing have realized for a long time that one of its bug-bears seemingly necessary, has been the formation of dross. We know that dross is formed because the zinc absorbs iron and that a small percentage of iron will contaminate large percentages of zinc. This contamination comes from four sources,—first, from the work itself; second, from the sides of the kettle; third, from boiling dross; fourth, from the use of active fluxes.

✦ ✦ ✦

THE writer decided to attack these problems individually and first to approach the active acid situation. We know that by the use of active fluxes, such as muriatic, the situation was acute. We first cleaned the scale from the work by either sulphuric or muriatic acid; then used the water wash; then we brought this clean material to a bath of muriatic. The muriatic was used on the theory that the clean condition of the work must be maintained until its immersion in the zinc and that the best protection for this was a flux wash, but, in the use of muriatic acid which is in itself a very active agent, we presented work to the bath coated with a heavy layer of iron salts which were very soluble in zinc. The problem, therefore, was to protect the clean work as it came from the water wash but not to attach to it this heavy layer of iron salts. After much experimental work with various types of materials, a neutral flux of zinc chloride with proper acidulation seemed to be the answer.

W. H. SPOWERS, JR.
Consulting Galvanizing Engineer.

✦ ✦ ✦

ABOUT this time the writer was called to a large range boiler plant in Tennessee because of what seemed to be an excessive dross accumulation in their operation. The muriatic tank was emptied and filled with the proper concentration of zinc chloride, properly acidulated, the sal ammoniac was dispensed with and the proper grade of zinc ammonium chloride substituted. The dross in this plant was immediately cut in half. This was the first practical application of the neutral flux technique.

✦ ✦ ✦

IT will be realized that when work is cleaned in dilute sulphuric acid, the result is accomplished because of the attacking ability of the acid on the steel submerged. When the work is removed from the sulphuric bath it is of course covered with a layer of iron salts.

These in usual practice are washed off in water. If the work then is washed with muriatic acid which is in itself a more active attacking agent than is the sulphuric, the work must then emerge from the muriatic with even heavier coatings of iron salts.

✦ ✦ ✦

WHEN the work is then immersed in the spelter this layer of iron salts, being very soluble in zinc, rapidly contaminates the zinc and forms dross in large quantities.

✦ ✦ ✦

IN cases where tight bond is required these salts have the effect materially of thickening or widening the interlining alloy structure in a zinc coat and as it is this structure, which, being brittle, causes the fracture upon bend it will be seen that a thick interlining alloy layer such as caused in this way causes disaster to the bond on bending.

✦ ✦ ✦

WE know also that in order to produce a perfect bond in all forms of galvanizing it is necessary to present perfectly clean work to perfectly clean zinc. The technique in regard to presenting clean work free from these disastrous iron salts has heretofore been accomplished by the use of properly acidulated zinc chloride with the elimination of the muriatic acid, the zinc chloride being neutral in its action.

✦ ✦ ✦

WE come next then, to the problem of maintaining a clean surface of spelter through which the work is to be immersed. For many years this has been accomplished by the use of sal ammoniac.

✦ ✦ ✦

SAL ammoniac is the crystalline chemical ammonium chloride (NH_4 CL). When the sal ammoniac is thrown on the molten zinc (which is at 840° F to 900° F) a large part of it is immediately volatilized and escapes into the air as a white fume and is lost. This characteristic of sal ammoniac, to volatilize readily, is at the same time the reason why sal ammoniac serves as a suitable flux. The first step in this volatilization is a breaking down of the NH_4 CL into NH_3 (Ammonia) and dry HCL gas. These combine again and appear as the sal fume, familiar to all galvanizers. During the period when the sal is broken down, however, the dry hydrochloric acid (HCL) gas has an opportunity to attack any zinc oxide present on the surface of the molten zinc and also the molten zinc itself. This it does and forms complex zinc ammonium chlorides and zinc chloride. This reaction is necessary and when the layer of fused chlorides is formed the fuming is less violent because this layer tends to retain any further additions of sal in solution. This whole process while very effective is very wasteful and has led to my efforts to produce an effective and more economical flux. It seems highly probably that but 30% to 40% of the sal actually thrown on the kettle stays to do useful work.

✦ ✦ ✦

SHOP practice now is to keep some of the flux left on the kettle at the end of a day's operation. This old flux is put on the kettle the first thing the following morning and new sal is added to this fusion.

✦ ✦ ✦

SHOP practice also is to add small amounts of saw dust, bran, oatmeal, tallow or glycerine to the sal before putting on the kettle or to add them to the fused flux on the kettle. These materials cause the fused flux to form a froth which is thick enough to eliminate fuming to a large extent and thus economize in the use of sal. The froth may be as high as 6 or 8 inches and may differ in stiffness depending on the requirements of the operation. The mixing of these frothing materials is not done to a formula but is left to the judgment of the kettle operators which leads to troubles.

✦ ✦ ✦

A FROTH is necessary in the operation because it contributes to a more satisfactory wetting or covering of the complete surface of the material entering the kettle to be galvanized, which is essential. Preferably the material to be galvanized should be dry when put in the kettle to avoid dangerous steam explosions, but most continuous operations do not permit drying and a suitable frothy flux minimizes troubles of this sort. Unless the flux froth is kept in a very active condition by frequent additions of both sal and froth producer it soon loses its effectiveness and, in fact, becomes unsatisfactory not only because of failure to secure proper galvanizing but also because the spent flux adheres to the work and causes black stains as it comes out of the kettle. This generally results in a second galvanizing of such stained work to put it in condition for sale.

✦ ✦ ✦

IN order to have a more perfect action with the use of zinc chloride as a flux wash zinc ammonium chloride was then used for the volatile flux on the surface of the kettle.

✦ ✦ ✦

ZINC ammonium chloride is a crystalline compound of one of two possible formulas and may be looked upon as a material containing substantially equal parts of zinc chloride and ammonium chloride In reality it is approximately the chemical that exists on the kettle in a molten condition after the fluid flux is formed when starting with sal ammoniac. Its advantage, therefore, lies in avoiding the heavy NH_4 CL losses met in forming a new flux from sal ammoniac and in maintaining the NH_4 CL somewhat longer in the molten flux. Since this material contains approximately 25% zinc already there is a further economy in its use since at equal price with sal ammoniac this zinc offsets the cost of the equal weight of the molten zinc otherwise required to form the same flux conditions when sal ammoniac is used.

✦ ✦ ✦

THE same frothing agents may be used and in the same way as with sal ammoniac. Zinc ammonium chloride at equal prices with sal is the cheaper and better material to use. As the galvanizers operate in general they do not obtain all of its advantages and

look upon it as replacing sal pound for pound in their work. This, though, is measurably their fault.

✦ ✦ ✦

IT will be seen therefore that in both of these methods, viz: muriatic with sal ammoniac or zinc chloride with zinc ammonium chloride, it is necessary to maintain two separate and distinct operations both of which were far from satisfactory. It was obvious that we must combine these two steps by some means in order to eliminate the great quantities of either sal ammoniac or zinc ammonium chloride which must needs be continuously added to the top of the kettle for the purpose of maintaining the volatile flux. But at the same time we must retain in any event the clean surface and clean spelter procedure.

✦ ✦ ✦

Special Flux Developed

A special type of fluxing material was perfected after many months of research and trial. This became known as No. 20 Flux.

This flux has been developed to meet the need for an efficient, constant flux that will not only create a satisfactory frothing flux most economically but will also provide the most stable and effective froth. There is nothing in the flux that will damage the work or the molten zinc in the kettle. There is no reason for the workmen to observe any other personal safety precautions than they now follow in the fluxing precautions.

✦ ✦ ✦

THIS flux is a new development with the frothing agent self contained so that there is no need for the addition of bran, oatmeal, etc. This means that the user is saved the expense of this material as well as the expense of warehousing and mixing it. It means that as he adds each pound of No. 20 Flux he obtains a uniform and constant froth best adapted for his purposes. The user can provide himself with a flux froth that will meet his operating conditions best.

THIS flux is now used in very substantial quantities and many factory tests have proved its suitability for the purpose for which it was developed. On a pound for pound basis it shows an economy in use of 20% over sal ammoniac when used in the customary way. There is less fume to annoy workmen and the froth to annoy stable and effective as a blanket and as a wetting agent on the incoming work. The reduction of the small explosions (spiting) caused by wet work entering the kettle can be completely eliminated by using a little care in building and maintaining the froth.

✦ ✦ ✦

THIS material is suitable for all types of galvanizing, including wire and wire products where both the old fluxes have failed to suit. A serious objection to the use of bran, oatmeal and sawdust to produce a froth is that they char readily and in many operations, such as galvanizing pipe, require skimming of the flux at frequent intervals to remove this char and prevent its carry through on the work where it causes unsightly black spots. No. 20 Flux will not cause this trouble under ordinary operating conditions.

✦ ✦ ✦

PRESENT practice on the materials to be galvanized and which have been pickled is to dip them in very dilute muriatic acid or a weak water solution of zinc chloride as a flux wash just before placing the material in the galvanizing kettle. This is an essential step and in most operations the material is still wet from this dipping when it is put in the molten spelter. Pipe, for instance, must be wet at this stage to facilitate the flow of the volatile flux and spelter through it.

✦ ✦ ✦

BY this new procedure the flux may be dissolved in water to make a solution of suitable concentration which can be used to replace either the dilute muriatic acid or zinc chloride flux wash just described. This solution will serve the same purposes that these other flux washes do and equally as well. The advantages in using this flux solution is that beside performing the flux washing operation, it carries over into the molten zinc and either instantly creates a suitable flux froth in sufficient amount to serve all the purposes of the volatile flux or carries over such quantities as will reduce to a minimum the necessity for hand additions of the solid material.

✦ ✦ ✦

THE careful development of this technique, which, so far as can be learned is new, will permit kettle operators to accomplish several desirable things. Since new flux is being introduced constantly by the incoming material to be galvanized a minimum amount of flux would be used always at the place where it is really needed, that is, the place of first contact of the work with the molten zinc. Since this solution produces a frothy flux as soon as it touches the molten zinc the present danger of spitting by work wet with either muriatic acid or zinc chloride can be eliminated. This reduces a safety hazard in the business and eliminates the loss of molten zinc which is thrown out of the kettle by this spitting. If the work has been dipped in the No. 20 flux wash solution and then has dried before reaching the kettle all of the actual flux and froth producing materials originally in the solution of the work will be there in a dry form and will function as described above. This technique is particularly attractive in its possibilities for better work and increased production with a reduction of rejections in the galvanizing of pipe and all hollow work where both inside and outside surfaces must be galvanized.

✦ ✦ ✦

WHILE, in general, this flux wash method will result in an economical use of the flux, in many operations it will possess other advantages that will outweigh the matter of economy in use in importance.

✦ ✦ ✦

THE present method of adding sal ammoniac to the existing

(*Please turn to page 184*)

High Tension Cable Production

PART II

By Otto F. Jagielski

Consulting Wire Mill Engineer

A Criticism of Some of the Mistakes Made In Processes Used In the Manufacture of High Voltage Cable and Suggestions as to the Improvement of Such Processes. ▼ ▼ ▼

To what extent will the previous operations, if carried out as mentioned, affect the drying and impregnating process in regard to the quality of cable? (See Wire & Wire Products, August, 1932).

BEFORE I go into more details of this question, it is necessary to describe very briefly the various processes now used in practice.

Drying

AFTER the cable has been preheated to about 245°F., it is placed in a tank and sealed carefully. The tank is heated to about the same temperature and then set under a high vacuum and the hot air passes into a condenser in which the moisture is condensed. As the vacuum is maintained in the condenser during the drying process and the heat of vaporization of the water **decreases** with **decreasing** air pressure, the drying process finally comes to a standstill and the vacuum in the tank and condenser has to be discontinued The air in the tank increases the application of heat from the heating unit to the cable and through its mass the capacity of absorbing the moisture. After the cable is heated again sufficiently the same procedure is repeated, only no more water is collected by the bottom of the condenser.

✦ ✦ ✦

THE number of drying processes depends on the moisture content of the cable at the start and the skill and knowledge of the operator. If the cable contains too much moisture it has to be air-dried in an oven before going into the vacuum-drying-process.

Impregnating

THE impregnating of the cable is usually done in the same tank. After the air is carefully removed during the last period of drying, the preheated and dried compound is led into the tank. Both the impregnating tank and the oil storage tank are kept under constant high vacuum and heat throughout the entire process. (Heat of compound is also about 245°F.)

✦ ✦ ✦

High vacuum, slow and uniform movement of compound and high temperature are the four most important features of a sufficient impregnation.

THIS is a very brief outline of one drying and impregnating method.

The methods of drying in all cases are similar, namely, through evacuation. However, there are many different opinions about the methods of impregnating the cables.

Here are briefly some of them which are used in some cable factories.

2—Have the ends of cable open (not covered with compound) during saturation.

3—Set the impregnating tank under air pressure after a certain time of impregnation, the idea being to force the compound into the cable faster.

4—The ends of the cable are connected to the vacuum pump, as is also the tank. After the tank is closed, the cable is evacuated, dried and impregnated. This method has the advantage that the paper layers nearest the conductor gets a good evacuation. At the same time the air which the outer layers contain, escapes into the tank. Thus the cable is dried and evacuated from two sides.

5—After the cable has been dried and the air removed, the compound is pumped into the tank until the cables are completely covered. The vacuum is maintained for a certain period of time after which oil is further pumped into the tank, completely filling it and building up the oil pressure. This oil pressure is to be maintained for a certain period of time depending on the type of cable impregnating.

✦ ✦ ✦

METHOD 3 and 5 do not seem practical. However, it is possible that the inner excess pressure is of advantage during the cooling period. It has not been proved yet, that a better cable can be made by these methods.

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METHOD 1 is generally used and method 4 is more general in the impregnation of hollow conductor cables.

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THE fact, however, remains that with none of these processes can the air and moisture be completely removed and there is nothing in sight to indicate that a process of this kind will be developed in the near future.

✦ ✦ ✦

THE drying and the impregnating process itself offers a num-

ber of sources which are inclined to create voids. For instance:

1—**The drying and impregnating is done under vacuum.** Now, since an absolute vacuum can not be obtained, a certain amount of air remains in the cable. Assuming the compound does not receive the proper heat before it enters the cable, or for other reasons that the cable is not impregnated properly—that is, that parts of the insulation are filled with compound — the air, which could not be removed concentrates in these parts.

2—**The used compound has a great expansion due to heat.** As the temperature of impregnation is considerably higher than the temperature of the room and the volume of the compound about 8% larger than that of a finished cable, the possibility exists that voids are created during the cooling period.

3—**Ingredients of the compound** which at the temperature of impregnation evaporate, may also create voids.

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GREAT care also is required while applying the lead tube, and any other operation till installed offers opportunities of creating voids in the insulation. For instance:

1—**If the lead tube is applied too loose** on the cable this may cause voids between the lead and the insulation.

2—**If the ends of the cable are not sealed properly** right after coming out of the lead press, the compound, being again heated, may flow out and leave voids behind.

3—**If the cable is bent,** one side of the lead tube stretches the other and buckles. Bending back also creates voids.

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AND there are many more sources for voids. In fact every move of the cable may mean voids and this is more true if the cable contains paper wrinkles, or other "soft points" in the insulation.

IN general the statement is made **"if the cable contains paper wrinkles or other voids due to poor workmanship, these voids will be completely filled with compound during impregnation and therefore will not weaken the cable electrically very much."**

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THIS may be true but due to the facts mentioned before, the remainder of the air will find its way easily enough to these soft points (wrinkles) and concentrate there during the cooling period and there is only one chance out of a hundred where a wrinkle may remain completely filled with compound and these few may be disturbed by bends, shocks, etc. and also by changes of temperature while the cable is in operation.

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I FEEL that the last mentioned is not enough appreciated by the manufacturers of high voltage cable and therefore will try to outline what is assumed about the question of "temperature-change" and its result during operation.

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IT is known that the change of temperature creates a movement of the compound but it is not known how the movement takes place. The procedure therefore is only supposed and based upon the theory of high voltage cables.

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NOW, in order to give a clear understanding of why soft points (wrinkles or other defect of insulation) have to be prevented, it will be advisable to follow the "supposed" movement of compound when the temperature rises.

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AS the cable is put into operation the temperature rises and the compound starts to move.

As fast as the dried paper takes up the hot compound during the impregnation under vacuum, so small is the permeability when the paper is impregnated for the same compound at a lower temperature. The movement of compound therefore does not go through paper but finds its easiest way in the spaces between the paper windings. The compound of the inner layers, that is, the layers nearer the conductor, usually moves towards the conductor.

THE area of the conductor as a whole is about 30% larger than the actual area of all wires together; considering all wires round and equal in diameter.

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THESE spaces between the wires are filled with compound in part only at the start of the temperature rise, due to the fact that the cable has been impregnated with very hot compound and when cooled off, the compound has naturally shrunk, leaving open spaces behind.

(These open spaces within the conductor are not doing any harm and it will be noticed later in the article, that they even can be of advantage).

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THE drift of the compound in the belt is about the same as in the paper insulation of the conductor; that is, the compound moves in the spaces between the paper windings. However, the temperature of the compound in the belt is far lower than the temperature near the conductors. The heat also reaches the belt much later, if at all, and the compound will move with less force if due to heat, but it may be forced to move towards the lead tube of the cable by pressure built up in the center.

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AS to the fillers, it is assumed that the greatest heat will be in the center filler, as this filler receives heat from three directions. So, therefore, in the center filler the compound will expand first and find resistance on the surface of the three conductor insulations where the compound expanded before. The compound of the center filler therefore will force its way in a radial direction between the surfaces of conductor insulations to the three outer fillers. There the temperature is lower and the movement of the compound will be decreased, but it must be realized that the compound in the fillers while expanding, has a much greater movableness at a lower temperature than in the tightly wound paper layers at a higher temperature.

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HOWEVER, it is clear, so far, that the largest part of the compound is located in the center

of the cable and expands and moves towards the cooler periphery and so secures a considerable pressure against the lead tube.

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WHEN the operation is discontinued, the cable cools off, the compound, paper, fillers and conductor shrink to original volume and the inner high pressure goes back to normal.

The compound being forced to move during the heating period goes back very slowly, if at all, to its original position.

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THE lead tube, if stretched during the heating period, will remain larger if no other forces, such as those coming from a tightly wound steel tape around the lead tube, operate to put it in original position. But this is very improbable.

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I HAVE now described in a very brief form the drying process, the various processes of impregnation, some facts about leading, handling and operation of cable, from the point where the cable was ready to be dried and impregnated.

Of course, what I have said is known, but having these facts in front of the reader, the purpose of this article will be better understood.

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Conclusions

FROM this data we reach the following conclusions:

1—In the drying process of cable and compound the moisture cannot be completely removed.

2—In the various impregnating processes

a—the air cannot be completely removed.

b—high vacuum, slow and uniform movement and high temperature of compound are the four most important features.

3—The danger of creating voids during these processes is due to

a—the different grades of expansion of the different materials.

b—Evaporation of the ingredients of compound.

4—Poor application of lead tube may create voids.

5—Handling of cable may create voids by

a—Bends and shocks.

6—A temperature change during operation creates a displacement of compound.

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How will these six points affect the quality of cable when there are wrinkles or other voids due to poor workmanship and how will it be affected if these said voids are eliminated?

THIS is the answer to the subject of this article:

To 1

THE remainder of the moisture, of course, is evaporated during the drying process. In this stage the dielectric strength of the insulation would be weakened as a whole. When cooled off, the ingredients of moisture equally distributed throughout the insulation will also weaken the cable as a whole. In other words, there will not be particular points of high stress. But the cable does not remain that way. Due to the fact, that the compound is circulating during some periods of operation the ingredients of moisture have the tendency to concentrate to drops and place themselves in open spaces (wrinkles). This then is a point of high stress.

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To 2—a

THE remainder of the air also will concentrate in open spaces and what is said about moisture in (1) applies also to air. If there are no open spaces within the insulation; that is, if the insulation is a solid mass of paper and compound, the moisture and air will have the tendency to concentrate within the conductor and will not do any harm.

✦ ✦ ✦

b

IF the insulation contains wrinkles or other mechanical voids, a uniform movement of compound cannot be secured. In such case the movement of compound on the points of wrinkles is inclined to create bubbles and these may remain.

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SO the statement of some manufacturers that these large mechanical voids will be completely filled with compound during impregnation is not always justified. They may and they may not be filled but there is nothing sure about it. A uniform movement of compound can only be secured, if the compound finds equal resistance throughout the insulation.

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To 3—a

ASSUMING the mechanical voids are completely filled with the compound during impregnation and still hot.

When cooled off, everything shrinks and due to the fact that the compound alone has a greater grade of shrinkage than the paper and compound combined, the compound within the paper voids shrinks and the casing remains larger leaving a void behind. This is where the remainder of air, moisture and

(b)

possibly evaporated ingredients of the compound concentrate. There is nothing to prevent this trouble, except through the elimination of the mechanical voids in the paper insulation.

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To 4

A TIGHT application of the lead tube may affect the paper voids favorably.

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To 5

BENDS and shocks are inclined to squeeze the compound out of the paper voids. Bending back, the paper voids are being opened but the question remains whether the compound is being replaced by air, moisture and other unfavorable ingredients. The only way to eliminate this doubt is to eliminate the paper-voids.

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To 6

A CHANGE of temperature, as mentioned before, forces the compound to move.

Here also a uniform movement or a uniform expansion and shrink-

(Please turn to page 184)

Die Recutting, Polishing and Finishing

By J. R. Longwell, Engineer

The Carboloy Co., Detroit, Michigan

A description of the processes involved in finishing, polishing and recutting tungsten carbide dies. ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼ ▼

TUNGSTEN carbide dies may be be economically finished, recut and polished by using an abrasive powder for all rough work and diamond powder for the final finish. This is the usual practice on dies up to three-sixteenths of an inch (.187″). On dies larger than this considerable time may be saved by rough boring the die with a diamond boring tool. The saving in time is usually found to be greater than the tool expense so that the total cost for sizing the die is less than when sized by lapping with an abrasive powder. The die is then finished by lapping with diamond powder. The wide difference in diamond powder and diamond tools has prompted us in describing several grades of powder, satisfactory diamond tools, a method of making and grading diamond powder, and sharpening diamond tools.

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Diamond Powder

DIAMOND powder is sold pure and in combination with other materials. A brief description of several powders and the characteristics of each is given below.

(1) Diamond Powder made from clean, selected diamonds which are classified as Crushing Bortz. Bortz is available in many grades, some good and some poor. It is essential that the bortz be obtained from a reliable dealer if uniform powder is to be obtained. The grading of diamond powder must be done carefully if the powder is to be uniform from lot to lot. A method of grading which does provide uniformity is attached.

Diamond powder is sold which is made from:

(a) Chips from gem diamond cuttings and sawings. This powder is flaky and breaks easily. The flaky powder charges the lap very poorly, cuts slowly, and though low in price is usually not economical.

(b) Reclaimed stones of varying quality. This powder is usually not uniform in cutting qualities and often contains foreign particles which scratch the work. Usually this grade costs less per carat than pure bortz powder.

(c) Reclaimed diamond powder. Usually this powder is not pure diamond powder. The price is generally low and it cuts slowly.

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Lapping Compounds

ALLOY powder which is made up of diamond dust and some other abrasive. This powder cuts slowly, and is lower in price than the best diamond powder.

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General

THE crushing of diamonds and the grading of the powder is a simple procedure provided a few precautions are taken and care is exercised in following the same methods each time. The method described below has been in use for several years and has proved to be reliable.

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Crushing The Stones

A HARDENED steel mortar and pestle is generally used. The pestle should fit the bore in the mortar with as little clearance as possible. A loose pestle will allow the fine powder to leak out and be lost. Place a maximum of five carats of diamonds in the mortar, insert the pestle and then hammer the pestle with a light weight hammer, 8 to 12 oz., using quick sharp blows. About five minutes will usually give a good average powder. Too heavy a blow and continued pounding both tend to furnish a large percent of powder which is finer than commonly used. Crushing too many stones at a time will usually give a round edged powder which will not cut as well as sharp powder. Pounding for too long a period also tends to round the powder and consequently destroys the sharp cutting diamond crystals.

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UPON completion of the crushing, scrape the powder free from the bottom, top and sides of the mortar and the end and sides of the pestle and put into it at least one-half pint of oil. The powder flies easily so care should be taken not to blow or breathe into the mortar while emptying.

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Grading The Powder

THE best grades of olive oil are generally used in grading diamond powder. The process used in making olive oil is not sufficiently accurate to guarantee a non-varying quality and this sometimes leads to a considerable variation in the grading. Some concerns using considerable quantities of diamond powder have changed to a mineral oil and have adjusted the floating times to suit. However, a great deal of the powder is graded with olive oil, and we are, there-

(*Please turn to page 185*)

Lubrication of Wire Rope

By Mr. A. J. Morgan*

John A. Roebling's Sons & Co.

THE lubrication of wire rope is of vital importance to the safety and economy of the installation on which it is used. This subject is of interest and importance at any time particularly so in the days through which we are passing because the tendency is to postpone action and reduce expenditures on anything that is not considered essential. It is most unwise and dangerous to consider rope lubrication as a non-essential. Every user should realize that any apparent saving effected by neglect of this most important part of wire rope maintenance will actually result in a loss, due to shortened rope life, and may be the direct cause of an accident. It hardly seems necessary that this fact would need substantiating, but when it is realized how much effort and money has been expended in order to impress this fact upon wire rope users, it will be appreciated that it is not as generally recognized as it should be.

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IT is necessary in setting up any satisfactory lubrication practice to determine first the proper degree of protection and lubrication to meet the existing conditions. A general statement can be made to the effect that the safety of men, materials and production depend, in many cases, entirely upon wire rope, and the safety of that rope in turn depends upon a proper and thorough practice of lubrication.

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TO summarize briefly the product to be lubricated, wire rope made up of a number of strands, usually six or eight, of which six strand rope is most generally used, and each of these individual strands are made up of wires varying in number usually from seven to thirty-seven. The coarser ropes, or those with the fewer numbers of wires in the strands, are used mostly on haulages, tramways or similar installations where the degree of bending is not excessive. Where more flexibility is required, the 6x19 classification of ropes is in demand. For the extra flexible ropes, the 6x37 or 8x19 classes are used.

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IT will therefore be readily apparent that one broken wire in the different classifications of ropes represents a considerably different percentage of the total metallic area. It becomes, roughly, 1/42 of the total in a 6x7 rope and 1/222 of the total in a 6x37 rope, with of course the variations between, depending upon the construction used. This must be taken into account in determining the remaining strength of wire rope, which is not possible if satisfactory lubrication has not been maintained.

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THERE are, roughly, two groups of wires in a rope; the outside wires, or those in contact with the actual abrasion and wearing surfaces, and the inside wires which never come to the outside of the rope and are always hidden from direct observation. These inside wires, which do not come in contact with any exterior wearing surfaces, make up what is termed "the reserve strength" of a wire rope, and in order to make any surface inspection valuable must be figured to remain intact.

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IT is perfectly possible and practical to set up inspection practice for wire rope so that its condition can be closely approximated at any time, providing that corrosion is not a factor. If corrosion is a factor, any rules or data which may normally be used as a guide will be inadequate and consequently of slight value in determining the condition of that particular wire rope.

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THE corrosion which occurs inside the wire rope is often extremely hard to detect. This is sometimes due to the character of lubricant used, which, on applying, does not penetrate properly but gums the outside and effectively seals up any moisture which might be in the rope and prevents observation of the rope's condition in so far as corrosion is concerned. Very often an indication as to whether or not internal corrosion is present can be obtained by cleaning thoroughly in the valleys, or interstices, of the wire rope and observing at the points where the strands make contact. If slight pitting or rusting is observed at those points, it may be assumed that there is corrosion inside. Just how weakening and to what extent this corrosion has progressed is of course extremely hard, if not impossible, to determine by surface inspection.

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QUITE a bit of time has been spent in trying to bring out that corrosion can and does exist in a wire rope, with possibly serious consequences resulting, and also that this can be prevented.

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THERE is another point to bring out, which is oftentimes not realized nor appreciated, and that is that each and every wire in a wire rope can bear against three or more wires for its entire length. It will be appreciated, therefore,

*Paper presented at A. S. M. E. Lubrication Engineering Mt'g., May 25-26, 1933, Pa. State College.

that while these bearing surfaces are very narrow, in fact when new representing the tangent line of cylinders, nevertheless they represent definite bearing areas and should be lubricated. It would not seem necessary to point out to those familiar with lubrication what might happen if lubricant is not present under these conditions and the wires are subjected to the usual friction encountered when a rope is being bent or flexed. It is only hoped by this paper to make the users of wire rope realize that it is far from just a plain bar of steel, but it is really a machine having bearing areas much in excess of a great number of machines in use around mines and shops. In fact, it probably can be safely said that wire rope has more bearing area per pound than does the vast majority of machines in general use today.

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IT would seem, therefore, that the value and the need for lubrication of a wire rope could be briefly stated to be, first, to insure the safety of the rope in operation, and second, to reduce the friction and consequently increase the life of the wire rope.

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WIRE rope is inherently a safe mechanism, since the abrasion and broken wires observed by surface inspection indicate the remaining strength and therefore can be likened to a safety valve. Regardless as to whether or not definite value could be obtained by lubrication as a reduction of friction, which incidentally can be proved to be the case, this additional service could be treated more in the order of a bonus when taking the cost of lubrication into account. It is felt that the safety of the wire rope installation will amply justify the necessary cost to insure it.

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IF the olden days were considered to have ended about twenty years ago, it might safely be said that a very large percentage of the ropes in use in this country in the good old days were protected by a paint pigment worked up in boiled linseed oil. This was brushed or swabbed on the outside of the rope after it was closed. The hemp centers were lubricated by being run through pine tar, usually Stockholm.

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THEN more importance was attached to the subject of proper lubrication, and many studies were started on the subject, resulting in a great variety of products and several different practices. This has continued to the present day and is still going on. Out of all of the various procedures which are advocated and the ideas which have been developed, it can be safely said that there is agreement on the point that rope should be lubricated, both during manufacture and in the field. The wire rope users were, in a great many cases, convinced that rope should be lubricated by the manufacturer and that such lubrication not only should be but was sufficient for the life of the rope. In other words, they did not believe that thorough lubrication was entirely necessary on their part.

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FORTUNATELY this attitude has changed and suitable lubrication practice has developed with any number of wire rope users, usually as a result of recommendations of the wire rope companies. These recommendations very often resulted in the setting up of their own particular practices, embodying ideas brought forth by local conditions to be met. This is a very desirable development because the uses for wire rope are much more numerous and also the intense competition between the manufacturers of various types of machines has resulted in the paring of equipment to a minimum and, in some cases, below the minimum for economical wire rope service, although the operation as a whole may be satisfactory. Therefore, in order to meet the equipment conditions that have been developing, it has been necessary to take advantage of every possible practice or material to keep the service of wire rope on an economical basis. Needless to say, proper and suitable lubrication is very important in this connection.

WIRE rope has been developing into more of a specialty as the competitive conditions in the field have increased, with the result that a very great amount of rope is made today for specific duties and for that reason may be termed "special" or even "tailor made". The proper lubrication practice is also quite special and varies with the installation. What may be perfectly satisfactory on one installation might be far from satisfactory on another.

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IT does not seem possible at this time to set up a definite recommendation or practice for the lubrication of wire rope which will apply or be effective under all conditions. In addition to the different requirements of the installation, it would be well to bring out another thought in this connection, and that is that if a lubrication practice is developed by the men on an installation and they believe it to be proper, there is far more possibility of the rope being better protected as a result of that practice than would be the case if a better lubrication practice were recommended to them and used but with which the men did not thoroughly agree. This is a point which may seem rather trivial, but nevertheless it is true.

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THE problem of lubrication of wire rope naturally divides itself into two general classifications, each of which may be subdivided a number of times. The first general class is the lubrication of the wire rope during manufacture. The second one is the proper lubrication of the rope in service.

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IN reference to the lubrication of the rope during manufacture, there is the question of the hemp center, the strands and the rope as a whole. These of course are further sub-divided according to the specific purposes to which the rope is to be put.

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THE question of the proper lubrication of the hemp center immediately introduces a number of points of difference in the various practices and opinions of those

performing this work. The primary object is to place a suitable amount of lubricant or protector in the center. There are a number of ways of introducing this lubricant, one of which is running the center through a hot bath of lubricant, but so far as is known this is not in very general use today. A few other ways are boiling the center in lubricant, exhausting the air and filling with lubricant, thoroughly impregnating the fibres during its manufacture, and of course a number of variations of these. The question as to what is the proper material to use brings another difference of opinion, although fundamentally all seem to agree that it is the protection of the hemp center which is essential, so that its elasticity and resiliency may be retained, which naturally would assist in prolonging the life of the wire rope.

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IT might be well to touch on one particular point of difference in considering the action of the hemp center. One theory is that the hemp center acts as a reservoir which is replenished, or more properly, should be replenished at the regular lubrication periods. Another line of thought is that the hemp center should be treated with suitable material which would remain in the center and protect it. It is realized that there is much to be said in favor of the second theory. There is also considerable question in the minds of various manufacturers concerning the capacity of the hemp center to retain and furnish lubrication for the strands.

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THE argument against the hemp center acting as a reservoir seems mainly to be based on the action of a sponge under pressure, to which a rope center has been likened, and it is stated that a sponge under pressure cannot absorb water. However, it will be well to consider that even when the sponge is under pressure it has a natural moisture content, which of course would vary with the intensity of the pressure. The fact that it would not have as much capacity when under pressure as it would in its original state is unimportant. The important point is that it can absorb the amount of moisture that it is capable of holding even under the pressure to which it is subjected. If this be applied to the center of a wire rope, it will be appreciated that even though this center is under pressure it has a natural capacity for a certain amount of lubricant. With that amount of lubricant present, the center will be maintained for a longer period of time in its elastic state and will better stand the action of service. If the lubricant is not maintained, the center becomes dry, allowing moisture and corroding liquids to be absorbed and disintegration begins, resulting in lack of proper support for the strands and accelerated fatigue.

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THE examination of wire rope which has been in service furnishes a great amount of very valuable and practical data for setting proper and suitable practices. It is a definite fact that rope where thorough and sufficient lubrication has been practiced has a hemp center which is not dry, but lubricated and preserved as a result of this lubrication. The rope lasts longer because of this. In other cases the center has been found to be absolutely dry with no evidence whatever of any lubricant in it, although the lubricant was there originally. It might be well to emphasize the point that not even the amount of lubricant which could be maintained under the pressures existing was present. As a side-light on this condition—there was a rope made in one piece and then cut in two pieces and shipped to two different places. As far as could be determined physically these ropes were identical, since they were made at the same time and in one piece. The piece of rope going to one installation made a record, while the piece going to the other installation resulted in a complaint for short service. Samples of both of these ropes were examined, and it can be definitely said that the subsequent lubrication of these ropes in the field entirely governed the results. In the case of the rope which gave good service, the lubrication was very good, the hemp center maintaining its elasticity. As may be expected, the other rope was badly corroded and the hemp center had deteriorated so that it no longer furnished proper support for the strands.

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THE examination of other ropes which have been in service indicates that lubricant can be re-introduced, if that term may be used, into the hemp center, so that the center may be maintained in a lubricated state throughout its life. This, it would seem, is the important thing. It is evident that a proper practice should not let the center dry out so that the original lubricant would be replaced by moisture. As far as can be determined, everyone agrees, whether supporting one theory or another, that the hemp center should be lubricated and that whatever lubricant or preservative is used, this should particularly act to maintain the elasticity and resiliency of the hemp center and should in no manner be injurious to the wire. It would seem as though the main point of difference was what material to use, whether a straight preservative or a lubricant.

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THE ideal solution, of course, would be to have a lubricant or preservative which could be placed in the center and which would maintain itself throughout the life of the rope. This may be possible sometime. Therefore, if this be not obtainable at present, it would seem to be more logical to use a lubricant or preservative which could be replenished or maintained by subsequent applications of even a different material in the field. It is realized that this point is a controversial one, and it is merely the intention to introduce these thoughts, trusting that, in the main, wire rope users will benefit if they realize that additional service can be obtained from their ropes providing their lubrication practice recognizes the fact that the hemp center must also be considered.

THE application of lubricant to the strands can be accomplished in several ways, either during the fabrication of the strands or by suitable application of lubricant, having proper consistency, to the strand itself. Many variations of course allow the same results to be accomplished. Here again a considerable difference of opinion results in the proper type of lubricant to use. This may vary from various types and weights of oils to various types and weights of greases. This also requires that the subsequent duty which the rope is to perform must be taken into account and a lubricant used which will best give the required degree of protection and lubrication for most efficient service. There is a decided difference in the length of time this protection and lubrication will last, depending, naturally, upon the original materials introduced. It is usually the case that the more protection ability the material has, the longer it will last, and generally it is true that the more protection ability, the less the lubricating ability, and vice versa.

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EACH wire rope manufacturer uses, what, in his opinion, is most suitable for the particular service. Since developments have been made more or less rapidly, this naturally is changing from time to time. However, they are in definite agreement that proper and sufficient lubrication is necessary and also that it should act as a suitable base for field application of lubricant. This point is extremely important and should not be overlooked. There is no lack of agreement on the fact that the lubricant should not be harmful to a wire rope, and also that it should not be of a nature which would easily run off, even at summer temperatures, nor should it harden sufficiently to crack and strip off during the winter months. It should not be readily washed off. It should not be so gummy that it will catch and hold hard and gritty dust or particles and work them into the rope, thus hindering the penetration of subsequent applications. It should, further, not be of a nature which would absorb or be disintegrated by water or the usual corrosive liquids encountered in service.

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THESE same conditions should govern the choice of a lubricant to use on the outside of the rope after it is closed, should this be deemed necessary, which it is in many cases. This is accomplished in the shop, either at the time of closing the rope or by running it through a suitable bath afterwards. There are a number of ways of doing this.

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TO assist in indicating the importance of the characteristics for suitable wire rope lubricant, listed in Chapter 41 of the Lubrication Engineering Committee Report, it might be well to quote from the specification, "Wire Rope for Mines", as adopted by the Engineering Standards Committee as American Standards February 24, 1927, for which the American Mining Congress was sponsor. This contains, in Section 611, several good requirements; the complete section following:

SECTION 611:—LUBRICATION

Rule 6110: It is advisable that the lubricant recommended by the rope manufacturer be used.

Rule 6111: Wire rope lubricant should be commercially chemically neutral.

Rule 6112: It should not harden sufficiently to crack, chip, or peel, nor soften sufficiently to drip off the rope under extreme atmospheric conditions.

Rule 6113: It should not dry out rapidly in service.

Rule 6114: It should be practically free from moisture, not absorb moisture readily, and be impervious to surface moisture.

Rule 6115: It should be of such nature that it can penetrate between the strands to the core of the rope, and should be applied in such a manner as to secure the maximum penetration.

Rule 6116: It should possess such adhesive qualities as not to be thrown from the rope by vibration nor rapid motion.

Rule 6117: Its physical and chemical qualities should permit heating to liquid consistency for ease of application.

Rule 6118: Lubricant should be applied at frequent intervals to protect the wires of the rope from friction and corrosion.

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IT will be noted that these rules are of a general nature and still apply to lubrication of wire rope during manufacture and also subsequently while they are in service.

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THE choice of suitable lubricants for use in the field may prove to be somewhat different than the ones which can most readily be applied while the rope is being fabricated. It is easier to obtain thorough penetration with heavier lubricants during fabrication than it is in the field. It might be better to state it this way—that a material having more of the protector in it can be more thoroughly applied in the shop than usually is the case in the field. This, however is a general statement, and it should be realized that there are various types of protectors on the market which can be applied with reasonable thoroughness directly in the field.

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THERE seems to be very close agreement in the various methods which are recommended, on the fact that the rope should be cleaned and freed from moisture as thoroughly as possible. There are a number of ways of doing this, possibly the easiest and generally most satisfactory ways being to use compressed air or superheated steam jets, or a combination of both. There are also methods employing wire brushes and tools, shaped generally to the contour of the interstices of the strand, which rotate as the rope is passed through them, these tools cleaning out in the valleys or interstices of the rope.

✦ ✦ ✦

IT can readily be appreciated that that a great number of devices and methods can be devised to do this job. However, it can be stated, in general, that the rope should be as clean as possible and

(*Please turn to page 178*)

Save on Your

Winding Costs

With Winco PRODUCTS FOURX Enameled Wire

▲ ▲ ▲ All wire meets the most exacting requirements ▲ ▲ ▲

Winco PRODUCTS 4X Enameled Wire has been developed to replace single silk covered and single silk over enameled wire in the winding of small motor armatures, fans, high frequency radio transformer coils and other apparatus where high insulation values and ability to resist abrasion, are prime factors.

▲ ▲ ▲

Winco PRODUCTS 4X Enameled Wire is covered to the same dimensions as the fabric covered wires, and can therefore be wound without changes in armature slots, bobbins or winding jigs.

▲ ▲ ▲

Is superior in its ability to withstand high temperatures.

▲ ▲ ▲

Will withstand softening in the varnish dipping and baking operations.

▲ ▲ ▲

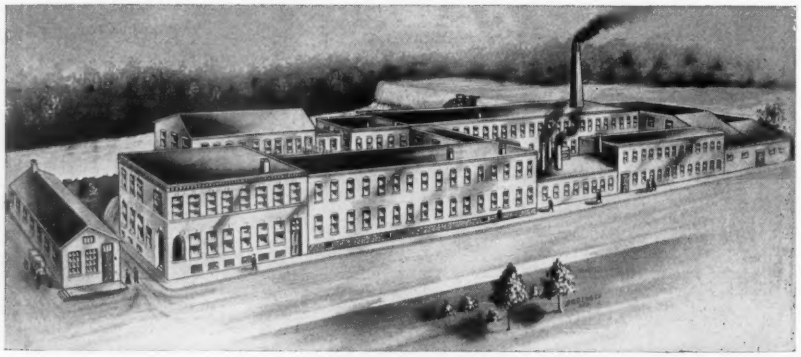
Requires little or no change in winding practice.

▲ ▲ ▲

Costs substantially less than the silk covered wire.

▲ ▲ ▲

Write for samples.



GENERAL VIEW OF PLANT, WINSTED, CONN. ▲ ▲ ▲

Products of leakage currents attack insulation and shorten the life of the coil. ▲ ▲

The only test indicating what the leakage loss in a winding may be is the test in mercury, which reveals the weak spots in the enamel covering. ▲ ▲ ▲

Our method of testing all wire by mercury test before shipment is calculated to give the user the highest degree of protection. ▲ ▲ ▲

ALL Winco PRODUCTS WIRE

GUARANTEED LEAK PROOF ▲ ▲ ▲

We would be pleased to quote on your requirements.

WINSTED INSULATED WIRE COMPANY

Incorporated

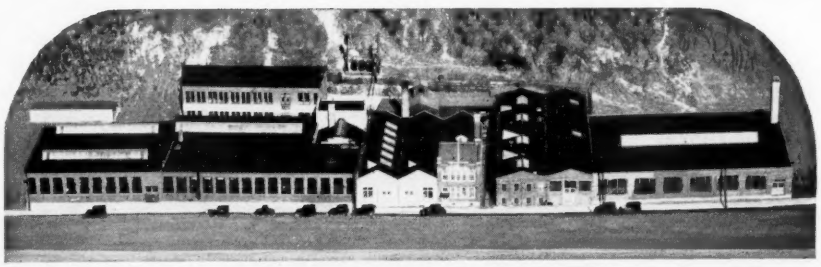
Winsted, Connecticut

"HUDCO" PRODUCTS...

Specially Processed Copper Wire...

For Enameling Purposes...

▲ ▲ ▲ Electrolytic and Oxygen Free ▲ ▲ ▲



AERIAL VIEW OF PLANT OF HUDSON WIRE CO., OSSINING, N. Y. ▲ ▲ ▲
▼ ▼ ▼ FINE WIRE MANUFACTURERS ▼ ▼ ▼

"HUDCO" High Conductivity Electric Wire

OTHER FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Cadmium, 10%, 18% and 30% Nickel Silver, Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification.

BRUSH WIRES, CRIMP and STRAIGHT

Brass, Steel, Nickel Silver, Copper and Phosphor Bronze

TINSEL LAHNS

Silver Plated Copper, False Gold and Copper

METALLIC FIBRE FOR PACKING PURPOSES

Copper, Bronze, Zinc, Lead and Aluminum

Wires for Metal Sprays

Zinc, Tin, Lead, Copper, Commercial Bronze, High Brass, Low Brass, Cadmium, 10% Nickel Silver, 18% Nickel Silver, Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel. Other wires to specification.

"Hudco" copper wire is drawn by the Hudson Wire Company of Ossining, N. Y., who have been specialists in the manufacture of fine wires for over thirty years. ▲

The best grade of copper drawing stock is used, insuring the maximum conductivity. ▲ ▲ ▲

A new process of drawing and annealing is used which produces a wire unusually smooth, clean and uniform in color for enameling and other purposes. ▲ ▲ ▲

Painstaking care in the selection and maintenance of dies guarantees a product accurate to gauge and resistance. ▲ ▲ ▲

You can rely on "Hudco" wire always. ▲ ▲ ▲

Expert annealing of the wire prevents unnecessary breakage when winding the wire into coils. ▲ ▲ ▲

If you, too, have a specific problem demanding wire of exact requirements, write to us about it. ▲ ▲ ▲

It costs nothing and involves you in nothing. ▲ ▲ ▲

Better wire at lower cost. ▲ ▲ ▲

"HUDCO"
FINE WIRES

We can serve you quickly and economically.
Send in your specifications for a quotation.

HUDSON WIRE COMPANY

Ossining, N. Y.

Estab. 1902 — Successors ROYLE & AKIN — Estab. 1902

"HUDCO"
FINE WIRES

(*Continued from page 175*)

also dried out as well as possible, and it is extremely important that the valleys of the rope be free from accumulated dirt or hardened and cracked lubricant. If this is not done, thorough penetration is not obtained.

✦ ✦ ✦

THE type of lubricant necessary and its application depends on the character of the service and the particular practice employed. This may consist of running the rope through a large troth or through a box, or having the lubricant brushed or swabbed on the rope,with a correspondingly large variation in these methods. There is also the drip system, which is used and advocated extensively, which consists of dripping the lubricant (necessarily relatively light material) onto the rope, ordinarily at the time the rope is bent over a heave. It is extremely difficult to lay down definite rules which will apply in all cases. Usually certain differences must be developed to take care of local and climatic conditions, the same as choosing the lubricant, where different qualities are often required to meet the various conditions encountered.

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THERE is general agreement between the recommended methods of lubricating wire rope on the fact that the lubricant should be applied so as to reach the inside of the rope. The lubricant should be of such nature that the penetration is thorough. Likewise, the lubricant should have body enough so that if applied hot or with a thinner, that upon congealing or the evaporation of the thinner, it will be in such condition that good protection will be given to the wires.

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IT might be well to consider the possibility of splitting the application in two parts, the first part of which would be set up so as to produce thorough penetration, using a relatively light lubricant, and the second part set up so as to produce a bonding and protection to the outside of the rope, together with some little penetration. Ropes treated in this manner have been observed to be effectively protected and lubricated, but, here again, the practice must be adapted to the particular conditions present and no definite law has been devised as yet.

✦ ✦ ✦

IT is an established fact that ropes can be maintained in a lubricated condition by any of the methods briefly touched on, providing the applications are sufficiently close together and sufficiently thorough. Therefore, it can be stated with assurance that thorough and proper lubrication can be accomplished.

✦ ✦ ✦

IT would be well to bring out before closing that corrosion, to be destructive to rope life, does not have to be the perfectly visible type with the characteristic color and deep pits. It can develop and exist in the form of microscopic pits which directly result in broken wires. A term which is undoubtedly correct for this type of fatigue break is "corrosion-fatigue". This is quite a bit more prevalent than is generally supposed, and we are citing it at this time to indicate that protection is also necessary along with the lubrication. As a further indication of the value of protection, it would be well to mention that several independent checkups have indicated that the fatigue limit of material, particularly steel, is reduced by the action of corroding solutions and even pure water. This is an attempt to once again bring out the necessity for the adoption of a suitable and thorough practice for lubrication by wire rope users.

✦ ✦ ✦

IT would be well to bring out at this time that the safety feature of wire rope is that it is made up of a multiplicity of individual members, a great number of which may break without allowing the load to fall. The safety valve is the fact that these broken wires can be observed in the great majority of installations. A visible indication of the condition of the rope is present for an inspector to observe. This, however, is not true if corrosion is a factor. When the corrosion is readily observed on the outside, then, of course, the inspector is warned sufficiently. However, there is corrosion which is far more dangerous, which is not visible from the outside, and it is the corroding of the inside wires which removes the reserve strength of the rope, thus making any estimate of the remaining strength impossible.

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IT is not the intention in this presentation to define the lubrication or lubricant other than in general terms, and the term "lubricant" is used in covering both protector and lubricant, together with its varying mixtures. This is, it is believed, more properly left to the manufacturers of the lubricant, and it is the sole intention to show briefly the various methods of applying, giving some of the fundamental qualities necessary and also, which is considered more important, to introduce the firm idea that lubrication of wire rope is necessary and can be properly accomplished.

✦ ✦ ✦

New Electric Conductor

A NEW British patent recently taken out by Dr. Max Weiset covers a composite conductor for use in electrical lines. When overheating occurs this conductor will cause some indication or signal to be given. The elements are so arranged that when temperature rises to an unduly high value a short circuit is instantly caused between a fusible conductor and, for example, its metallic casing. The latter is normally insulated from the former by means of helically wound tape, and as soon as fusion occurs, the molten metal passes between the spaces in the helix and makes contact with the casing. The position of the fault may then be quickly found by any known method.

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New Steel Cartel Formed

THE representatives of France, Germany, Belgium, Luxembourg, and the Saar affixed their signatures to the new international steel cartel agreement at a meeting at Luxembourg recently. It was decided to establish the international sales office for steel bars in Luxembourg, for half-finished products in Liege.

'Round the World With the Wire Industry

British to Build Wire Rod Mill

A PLAN estimated to cost £1,750,000, which includes the construction in Lancashire, England, of what will be one of the largest continuous wire rod mills in the world has been embarked upon by the Lancashire Steel Corporation, an organization formed in 1930 to take over several leading Lancashire iron and steel concerns. Production costs, it is stated, are to be materially reduced by concentrating all phases of the production of these rods starting with the raw materials and continuing without interruption through the manufacture of pig-iron, the steel ingots, blooms, billets, and finally the wire rods. All transport waste will be eliminated through plant design and provision has been made for the ultimate production of such wire products as barbed wire, wire netting, and nails in the same establishment.

✦ ✦ ✦

Japanese Consolidation of Iron and Steel Works Planned

THE Japanese Cabinet has approved a bill to be presented in the present Diet session calling for the consolidation of the principal iron and steel works of the country into a single company. Advices from Tokyo indicate that the approval of the merger is locally considered probable.

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Japanese Wire Prices During 1932

THE following data on prices in Japan of iron and steel products during 1932 have been published by the M. Iketani News Agency. The prices given are those of the wholesale market and may not in certain cases be the prices which have actually ruled transactions in many cases, but rather are those quoted for the information of the general public. These quoted prices follow:

Product and date of quotation	Highest	Lowest
Iron Wire (Seitetsusho's (per coil)		
	Yen	Yen
December, 1931	4.80	4.70
June, 1932	5.30	4.95
July, 1932	5.10	4.95
October, 1932	8.50	6.30
November, 1932	8.50	7.60
Wire Nails, Kobe, Inch (per keg)		
December, 1931	6.10	5.90
May, 1932	6.50	5.40
October, 1932	10.00	7.10
Round Steel Bars ⅝" (per metric ton)		
December, 1931	62.00	59.00
July, 1932	57.00	55.00
August, 1932	55.00	55.00

✦ ✦ ✦

British Completing Electrical Transmission Plan

THE fifth annual report of the British Central Electricity Board, covering progress and activities in 1932, has just been issued. An important section of the report deals with the progress of the National Grid project for standardizing electrical transmission throughout the United Kingdom.

✦ ✦ ✦

IT is explained that the Grid comprises approximately 3,000 miles of primary transmission lines operated at 132,000 volts, linking up selected stations with one another and with the systems of other authorized undertakers in the areas, and inter-connecting the areas themselves. In addition to the primary transmission system there are about 1,000 miles of secondary lines operated at 66,000 or lower voltages.

✦ ✦ ✦

CONSTRUCTION of the lines in 1932 advanced almost as rapidly as in the previous year, more than 1,350 miles of towers having been erected in the course of the year. Of the entire transmission system of approximately 4,000 miles, inclusive of cables, only 212.5 miles of towers and 3.5 miles of cables have still to be completed. It is mentioned that the cost of constructing the Grid is now ascertainable within narrow limits and will amount to about £26,700,000 ($133,500,000). The cost will come out, it is calculated, within 2½ per cent in excess of the Commissioners' estimates, despite substantial expenditure on experimental lengths of 132,000-volt cable, and on the deviation of lines and the placing underground of some sections of secondary lines for the preservation of amenities.

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RESEARCHES have been continued with the object of reducing the cost of tapping the primary transmission lines and rendering the Grid more widely available for developing load in areas of low density.

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A NOVEL and interesting departure in high-voltage cable construction has been inaugurated in the London area, where a 66,000-volt cable, drawn into steel ducts and surrounded by nitrogen under pressure, has been put into service between Hackney and Walthamstow. It is described as the first cable of this type to be put into commercial service in the world. It has the advantage of approaching in simplicity the standard of conventional solid type cable and of improved protection against mechanical damage.

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THE maximum amount which the Board is empowered to borrow to carry out this gigantic scheme is £50,000,000 ($250,000,000). During the year the Electricity Commissioners issued consents to the borrowing of the Board of £4,050,400 for the purposes of the Grid, making the total amount so far sanctioned £29,250,400 ($146,252,000).

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SINCE the publication of this report an important piece of work has been carried out on the project. As part of the scheme for linking up main power stations, British Insulated Cables, Ltd., recently stretched cables across the River Tyne a few miles west of Newcastle. River traffic was temporarily suspended while three cables were placed in position forming part of the Newcastle-Galashiels link.

'Round the World With the Wire Industry

New British Standard Wire Specifications

TWO important standard wire specifications—one a revision, the other new—have just been issued by the British Standards Institution. The new specification relates to square mesh woven wire and round hole perforated plate sieving materials for industrial purposes. It provides for the more commonly used forms of woven wire and perforated plate and has a wide industrial application, covering as it does the fine woven wire sieving material used in biscuit making, goldmining, brewing, etc., up to the very heavy forms of perforated plate used in the coal mining and quarrying industries.

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TWO series of woven wire are included in the specification, characterized by (1) clear mesh sieves in which the size of the aperture is expressed in inches or fractions of an inch, and (2) the number of meshes per linear inch, this series containing sieves ranging from 300 meshes to the inch down to four meshes to the inch. It has been found practicable to standardize perforated plates other than those having round holes staggered at 60 degrees. Two series of perforated plates have been provided, a heavy series with holes from 3 in. to 1/16 in. diameter, and a light series with holes from 1 in. to 0.029 in. diameter. In consequence of the great variety of lengths and widths used in industry, it has not been found practicable to standardize overall dimensions of woven wire or perforated plates.

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THE revision is of an old specification for trolley wire, first issued in 1905. The specifications drawn up jointly by the Municipal Tramways and Transport Association and the Tramways, Light Railways and Transport Association have been taken as a basis for the new standard work. The specification takes full account of the advances made of recent years in cadmium-copper wire, and hard-drawn copper and bronze are also recognized as standard materials. Both round and grooved sections of wire are provided for, and the range of sizes extends from the smallest street railway trolley wire to the largest railroad contact wire in general use or likely to be required for some years to come. The standard dimensions of the trolley wheel groove are also given.

✦ ✦ ✦

New Cable Sheathing Alloys

A SPECIAL research report just issued by the British Department of Scientific and Industrial Research deals with B. N. F. Ternary Alloys of Lead and their use in buildings. The report describes two new ternary alloys of lead recently introduced by the British Non-Ferrous Metals Research Association and suggests the possibility of saving from 20 to 30 per cent on the cost of much of the lead used for building purposes.

✦ ✦ ✦

THE two new materials, known as B. N. F. Lead Alloys Nos. 1 and 2, are formed in one case by adding to the lead ¼ per cent of cadmium and 1½ per cent of tin. The new alloys were originally developed by the association to overcome troubles due to the cracking of lead used for sheathing of electric cables. This trouble was met with in places where the cables were exposed to excessive vibration. The new alloys, which have at least four times the resistance to vibration of pure lead, have solved this difficulty completely. The General Post Office has applied these alloys for submarine cables, which have already consumed a great tonnage, while the Admiralty, after thorough trials, has specified a ternary alloy to be used exclusively for the sheathing of all cables installed in British warships.

EXPERIMENTAL tests have shown that the resistance to corrosion of the alloys is at least equal to that of pure lead. Further experiments on the corrosion resistance of the alloys in various soils are being made; but for the time being responsible authorities, to be on the safe side, consider that pipes of the full wall thickness should be used for underground service. Even so, the report suggests that where there is much vibration it might be well worth while to incur the slightly increased expense of using B. N. F. alloys for such building operations.

✦ ✦ ✦

EXHAUSTIVE tests are being carried out on the frost resistance of the new materials, and the tests so far made show that the thinner alloy pipes is the same as that of the thicker lead pipes of equal strength which they replace. Experiments now under way are chiefly concerned with pipes, the materials value as a cable sheathing having been fully proved.

✦ ✦ ✦

British Machine For Marking, Measuring And Cutting Electric Wire

A CONSIDERABLY improved machine for marking, measuring, and cutting electric wire and cable has recently been introduced in Britain by B. & F. Carter & Co., Ltd., Rochdale, Lancashire. The machine can be adapted to mark or cut the cable in multiples of five yards or 15 feet up to a maximum length of 300 feet.

✦ ✦ ✦

THE machine is arranged with instantaneous trip motion which releases the guillotine for cutting the cable at any required number of yards or feet. This guillotine is set back into position by Treadle motion. The machine is built up on a fabricated steel welded base plate with standards and pillars made of the same metal electrically welded into position which makes the bed plate very strong and practically indestructible.

'Round the World With the Wire Industry

THIS wire-cutter is self-contained and is driven by the cable being drawn through the users coiling machine. It has an all-aluminum measuring wheel 2½ yards in circumference able to handle braided cable, lead or rubber-covered twin cable. The makers claim that with this machine the number of short lengths left on a reel is reduced; it can be ascertained easily what length of cable is on the reel, and the cable can be continuously cut off at any predetermined length. Cable and wire users should find this machine invaluable.

✦ ✦ ✦

The Wire Industry of Belgium

THE modern wire industry was first introduced into *Belgium* a century ago with the establishment of the Societe Anonyme des Clouteries Mecaniques. Thereafter the progress of the mechanical wire and nail industry was rapid—the Societe des Clouteries Otlet being founded in 1842, the Usines L. Bekaert in 1880, and the Clouteries Baudoux and the Societe en Commandite Leandre Henne in 1887. At the present time there are seven active plants in this industry—

Clouteries et Trefileries des Flandres	14,500,000	francs
Trefileries L. Bekaert	15,000,000	"
Trefileries et Clouteries de la Paix	12,000,000	"
Sambre-Escaut	12,000,000	"
La Fontainoise	3,000,000	"
Clouteries Baudoux	800,000	"
Usines Dercq	1,000,000	"

In addition four plants in Belgium turn out screws. These are Sambre-Escaut, at Fontaine-l'Eveque; La Visserie Belge S. A., at Laeken; Les Visseries et Trefilieries Reunies, at Haren; and Les Usines Dercq S. A., at Fontaine-i'Eveque.

✦ ✦ ✦

ON November 25, 1931, Belgium wire and nail manufacturers formed the Societe Cooperative neon des Trefileries et Clouteries Belges which was given the monopoly of sales of the Belgium plants. This organization in turn created the Compagnie Nationale pour l'Exportation des Products Trefiles which was given the monopoly of exports of wire, nails, rods, triple twisted wire fencing and bed springs. Each member organization has been given a quota-Clouteries et Trefileries des Flandres having the largest proportion, 29.598 percent.

✦ ✦ ✦

THE above quotas apply to the manufacture of iron and steel wire only, copper and bronze wire producers in Belgium being as follows:—Les Usines a Cuivre et a Zinc de Leige, La Societe Anonyme Franco-Belge des Laminoirs et Trefileries d'Anvers, Les Laminoirs et Trefileries de Hal, and Les Visseries et Trefilieries Reunies de Haren.

✦ ✦ ✦

Cuban Market for Barbed Wire

EUROPEAN and particularly continental barbed wire is replacing the American product in the *Cuban* market advises Assistant Trade Commissioner R. Horton Henry from Habana. No official figures are yet available for 1932, but preliminary statistics indicate that imports of wire products, including barbed wire, staples, nails, and plain wire, through the port of Habana — approximately 4,200 metric tons—was roughly 70 per cent of European origin. In 1929, the reports goes on, the United States supplied 74.84 percent of the Island's total requirements for barbed wire with Belgium supplying 21.99 percent. In 1931, however, the share of the United States dropped to 52.96 percent while Belgium increased its participation to 32.14 percent. Total barbed wire sales in 1929 amounted to $405,079 whereas in 1931 they totaled only $145,078.

✦ ✦ ✦

BARBED wire is admitted into Cuba duty free and therefore no advantage accrues to the United States under the provisions of the Reciprocity Treaty. The advantage of European exporters of time results, it is stated, from an barbed wire to Cuba at the present ability to underquote the American product by nearly 10 percent.

✦ ✦ ✦

Ferelli-General Cable Works, Ltd. Completes Big Cable Order

In connection with the description of "British Railroad Electrification which appeared on Page 78 of the March issue it will be of interest to note that the main powers cables were supplied by Ferrelli-General Cable Works, Ltd., of Southampton. The contract for this system comprised approximately fifty miles of three-core .10 sq. in. paper insulated cable of the triple lead sheathed type for 33,000 volts working pressure. These cables were for feeding the eighteen substations from the Croydon, Three Bridges and Brighton 33,000 volt transforming stations of the Central Electricity Board.

Again, supervisory control of the substations is exercised through a multi-core cable system from the Control Station at Three Bridges and the signal and control cables manufactured and laid by ourselves comprise about 30 miles of 17-core cable, 30 miles of 33-core cable, 8 miles of 12-core cable and 48 miles of 4-core cable, all lead alloy sheathed and double steel tape armoured.

✦ ✦ ✦

SIR Montague Hughman has been appointed chairman of W. T. Henley's Telegraph Works Co., Ltd., famous British cable manufacturers, and W. F. Bishop and Sir Maurice G. Simpson have been elected directors. Sir Montague succeeds Sir George Sutton, for many years one of the best-known chiefs of British cable works.

P. V. Hunter and C. Pipkin have been appointed advisory directors of the Callender's Cable & Construction Co., London.

A Review of Recent Wire Patents

No. 1,900,041, CARL P. BRODHUN of Wilkes-Barre, Pennsylvania, assignor to The Okonite Company of Passaic, New Jersey, a Corporation of New Jersey.

Metallic protective sheathing and windings are dispensed with in the construction of this electric cable, the construction including a wire conductor with a layer of rubber compound around the conductor, a layer of fabric strips around the layer of rubber compound, a layer of jute cord around the layer of fabric strips and a protective layer of rubber wound in strip form around the layer of jute cord.

✦ ✦ ✦

No. 1,900,160, WIRE SHAPING MACHINE, Patented March 7, 1933 by Joseph Cipko of New York, New York.

The machine is particularly adapted for bending a wire into a plurality of scallops. The bending disc employed in the construction is so arranged that it may be adjusted around its axis in a manner so as to control the size of the scallops.

✦ ✦ ✦

No. 1,900,309, TWISTING AND REELING MECHANISM FOR WIRE ROPE MAKING MACHINES, Patented March 7, 1933 by William E. Somerville, of Coal City, Illinois.

One of the objects of the invention is to provide new means for guiding or directing the cable or rope onto the reel as well as new means responsive in its operation to the rotation of the reel, whereby the speed of actuation of the guiding means with respect to the speed of rotation of the cradle employed may be varied or controlled.

✦ ✦ ✦

No. 1,900,310, TWISTER OR STRANDER, Patented March 7, 1933 by William E. Somerville of Coal City, Ill.

In many machines of this character, the twisting mechanism has been mounted upon a revolving cage, and in order to produce the desired results, it was necessary to rotate not only the twisting mechanism per se, but also the cage. In applicant's construction, the cradle is held against rotary movement while the arms are rotated, and with the construction employed two cables may be manufactured at the same time.

✦ ✦ ✦

No. 1,900,492, ARMORED CABLE, Patented March 7, 1933, by Otto A. Frederickson of Ben Avon, Pennsylvania, assignor to National Electric Products Corporation of New York, N. Y., a Corporation of Delaware.

The invention lies particularly in the kind of covering employed in place of the ordinary braided cotton covering for armored cables. The construction includes a central wire conductor having a rubber covering therearound, a number of separate individual tape-like fabric servings about the rubber covering, and asphaltic saturant applied exteriorly to the fabric servings and impregnating the same and sticking the individual servings to the rubber covering. The exterior covering for the armored cable comprises transversely crumpled paper servings.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

No. 1,900,600, HIGH TENSION ELECTRIC CABLE, Patented March 7, 1933, by Luigi Emanueli of Milan, Italy, assignor to Societa Italiana Pirelli, a Company of Italy.

The invention relates to "oil-filled" cables and the hollow metallic core thereof which serves to contain the impregnating fluid also forms a low resistance conductor for electric current. The core is made in the form a helix with a comparatively long lay and is arranged to have an electric resistance of such order that the helix also serves as a current carrying conductor of the cable. The strip is so twisted that the edges are brought into close proximity but leaving between them a narrow longitudinally extending slot of long pitch spiral form thru which the oil flows radially.

✦ ✦ ✦

No. 1,900,695, METHOD OF AND MACHINE FOR BINDING CABLES, Patented March 7, 1933, by Arthur R. Curtis of Cleveland, Ohio, assignor to Superior Carbon Products, Incorporated, of Cleveland, Ohio, a Corporation of New York.

The method in this patent comprises initially forming a loop of wire around the conductor by forcing the conductor and the wire into a pair of clamping jaws, completing the loop by clamping the jaws together and clinching the loop by forcing the ends of the wire into engagement with the conductor.

✦ ✦ ✦

No. 1,901,514, METHOD OF PRODUCING WIRE RODS, Patented March 14, 1933, by William Herman and William H. Sommer of Peoria, Illinois.

In this method for continuously producing wire rods from a number of commercial-length billets, the billets are placed end to end and, while moving the billets in such relation, their abutting ends are butt welded to produce a continuous length of bar and thereafter, by a series of operations on the bar and without interrupting the movement of the bar successively and alternately rolling and stretching the bar, the cross-sectional area of the bar is reduced to rod size.

✦ ✦ ✦

No. 1,901,720, UPHOSTERING SPRING, Patented March 14, 1933, by Moritz Bärwinkel, of Ohrdruf, Germany.

The invention is characterized in that the end of the spring bearing against the seat frame has no direct fastening means on the frame. For example, the one end of the spring is hingedly fastened on the frame whereas the other end is axially shiftable, but bears otherwise freely on the frame.

✦ ✦ ✦

No. 1,901,747, HELICAL CONNECTER, Patented March 14, 1933, by William A. Holt, of Mebane, North Carolina.

This wire connecter is adapted for joiinng together the vertical coils comprising bed bottoms and the like. The connecter consists substantially of a helical spring having a perforated hooked end which is capable of engaging the vertical coils without being twisted and which is provided with a humped portion designed to prevent disengagement of the parts.

✦ ✦ ✦

No. 1,903,698, SPINDLE FOR WIRE COVERING MACHINES,, Patented April 11, 1933, by Eugene Dowald of Wuppertal-Elberfeld, Germany.

According to this invention, the spindle has an oil hole at its lower end, from which the lubricant, pressed in by a squirt while the spindle is running, can be supplied to the bearing points. The pressure channels are longitudinal grooves in the spindle axle, which latter is enclosed by a sleeve.

✦ ✦ ✦

No. 1,903,953, WIRE FEED DEVICE, Patented April 18, 1933, by James L. Anderson of Tenafly, New Jersey, assignor to Air Reduction Company, Incorporated of New York, N. Y., a Corporation of New York.

The object of the invention is to provide a device for feeding either the weld wire used with oxyacetylene welding or the electrode wire used in arc welding into a fusion weld, means being provided to feed the wire into the weld at any rate which is required.

✦ ✦ ✦

No. 1,903,975, SUBMARINE SIGNALING CABLE, Patented April 18, 1933, by Oliver E. Buckley of Maplewood, New Jersey, assignor to Bell Telephone Laboratories, Incorporated, of New York, N. Y., a Corporation of New York.

This invention applies particularly to submarine signaling cables of the concentric return type and the object is to prevent extraneous inducive disturbances from interfering with the intelligibility of the signal transmitter. The construction includes an insulated central conductor, a concentric return conductor surrounding this first mentioned conductor, means surrounding the return conductor for causing the return to flow chiefly through the concentric return conductor, the means including an envelope of magnetic material having a low magnetic reluctance in a closed path circumferential to the cable.

✦ ✦ ✦

No. 1,903,992, SUBMARINE CABLE LOADING COIL, Patented April 18, 1933, by John J. Gilbert of Douglastown, New York, assignor to Bell Telephone Laboratories, Incorporated, of New York, N. Y., a Corporation of New York.

An object of the invention is to reduce hysteresis and eddy current losses in coil loaded submarine signaling cables. In the construction of the cable, a number of loading coils are placed within a suitable armor, the coils having elongated cores of magnetic material for lump loading the cable and being arranged in at least two groups of which one is located adjacent the ends of the cable and the other is located more remote from these ends, the coils contained in the first mentioned group being different from those contained in the last group in that they have longer cores, lower hysteresis losses and having lower ohmic or pure resistance losses.

Exports and Imports of Wire

Exports of iron and steel wire products in March, 1933 and March, 1932
(In gross tons)

	March 1933	February 1933	March 1932
Wire rods	148	2,035	2,733
Hoops, bands and strip steel	735	959	1,522
Plain black or galvanized iron or steel wire	571	500	1,397
Barbed wire and woven wire fencing	1,691	1,775	2,562
Woven wire screen cloth	73	28	56
Wire rope	233	84	145
Insulated iron or steel wire and cable—see new analysis below			
Other wire and manufactures	179	140	238
Wire nails	482	479	615
Tacks	36	42	36
Other nails, including staples	153	299	308
Bolts, machine screws, nuts, rivets, and washers	312	241	266
Total, these 11 classifications	4,613	6,582	9,878

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Concrete reinforcement bars	303	182	3,189
Hollow bars and drill steel	74	74	98
Merchant steel bars	1,506	1,812	3,529
Wire rods	1,017	918	973
Barbed wire	799	1,100	1,551
Round iron and steel wire	420	173	211
Telephone and telegraph wire	....	....	1
Flat wire and strip steel	71	60	59
Wire rope and strand	116	137	146
Other wire	116	63	23
Hoops and bands	1,077	1,751	1,454
Nails, tacks and staples	620	558	930
Bolts, nuts and rivets	11	21	7
Total, these 13 classifications	6,130	6,849	12,171

Exports of Insulated Wire and Cable
March, 1933

	Lbs.	Value
Insulated iron or steel wire and cable	1,256	$ 243.00
Rubber covered wire	186,361	31,533.00
Insulated copper weatherproof wire	52,324	6,695.00
Wire and cable telephone cable	5,205	1,061.00
Other Insulated copper wire	69,707	15,437.00
Nickel-Chrome Electric Resistance Wire	30,074	33,051.00
Total, these 6 classifications	344,927	$88,020.00

AIDED no little by the sharply rising trade in scrap, the volume of the United States foreign trade in iron and steel—particularly the export trade—rose sharply in March. Exports totaled 80,567 gross tons, the highest figure for any month since July, 1931, and the March 1933, trade exceeded that of March 1932, by a margin of 60 per cent. A daily average of 2,599 tons was maintained in the month under review, a considerable increase over the 2,283-ton average for February.

✦ ✦ ✦

IMPORTS at 22,114 gross tons were the highest for any month since December 1932. They were, however, but 54 per cent of the March, 1932, trade.

✦ ✦ ✦

THE export total for March, 80,567 tons—exceeded that of February by 16,631 tons, a gain of 26 percent.

✦ ✦ ✦

THE first in importance (on a tonnage basis) among those to increase being scrap the trade in which gained 19,381 tons in March. With the exception of the 1,024 ton gain in galvanized steel and the 316 ton rise in the trade in black steel sheets all of the remaining gains were in minor amounts. Among the losses those in pipe (2,158 tons) and in wire rods (1,887 tons) were in any sizeable tonnage.

✦ ✦ ✦

THE leading products of the March trade were, in order of their tonnage, scrap, tin plate, galvanized steel sheets, black steel sheets, barbed wire, seamless casing and oil line pipe, and steel bars.

BY reason of her large purchases of scrap—32,549 tons out of a total trade of 33,761 tons—Japan continued to be the ranking market in the export trade in iron and steel products. A similar situation obtained with respect to Italy where, out of a total of 15,062 tons, 14,780 tons were also scrap. Not so with Canada, however, for that country's trade of 5,534 tons included a wide range of items among which were scrap (990 tons), steel bars (697 tons), hoops and bands (681 tons), and cold rolled strip steel (532 tons). With Poland the story of the Japanese and Italian trade is resumed for 4,326 tons out of her 4,328 ton total was scrap. With India we find that all save 79 tons of her 2,079 tons trade was scrap and of the German purchases of 2,049 tons, 2,041 tons was also scrap.

✦ ✦ ✦

THE import trade, which for three consecutive months had demonstrated a pronounced downward trend, abandoned this course in March when it registered a gain of 2366 tons to total 22,114. There were no sharply marked changes in the trades of individual products with the out-standing reductions those in hoops and bands, 674 tons, merchant steel bars, 306 tons; and in barbed wire, 301 tons.

✦ ✦ ✦

BY virtue of a gain of nearly 750 tons in her trade in March, Belgium regained her position as the preeminent supplier of iron and steel products to the United States—her total of 5,111 tons including 1,180 tons of merchant steel bars, and 742 tons of hoops and bands. Sweden shows sharply increased trade of 3,638 tons including 432 tons of wire rods.

✦ ✦ ✦

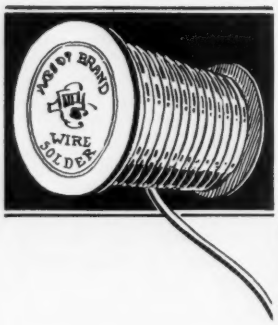
GERMANY'S total of 3,212 tons was made up entirely of small items with barbed wire (599 tons) shapes (503 tons), nails (487 tons) and wire rods (215 tons) leading all the rest.

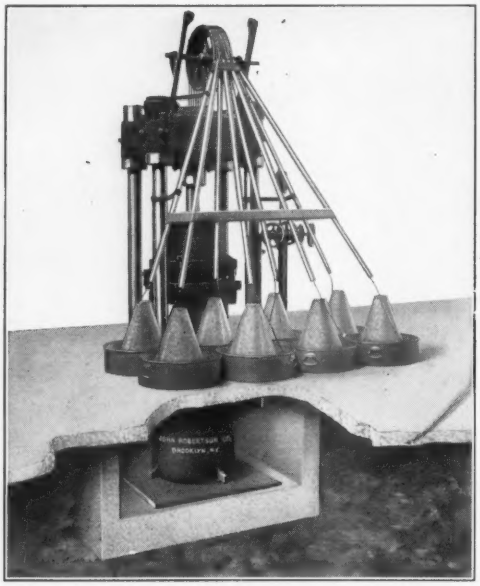
✦ ✦ ✦

CARD clothing imports in March more than trebled the February total at 12,359 square feet valued at $12,884. The United

(*Please turn to page 187*)

SOLDER WIRE
EXTRUSION PRESSES
---and Equipment





Above illustration shows a 400 ton SOLDER EXTRUSION PRESS by Robertson,—many of which are in successful use today. We are in a position to furnish all the equipment shown in this illustration, which includes: Dies, Multiple groove take-up wheel, Delivery Tubes and Coiling Pans (for extruding and coiling 8 or 12 strands of wire at one time). Solder wire as small as 14 gauge can be made with this equipment.

We are also prepared to submit designs and estimates on Presses and equipment for extruding smaller gauges of Solder, as well as Block Tin Pipe and other soft metal products.

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125-137 Water Street Brooklyn, N. Y.

Galvanizing Fluxes

(*Continued from page 167*)

flux on the kettle, to renew its usefulness, is to throw it on by the scoop or shovel. This is extravagant not only because the additions are generally excessive but also because in many operations, kettle areas are kept covered by active flux through which work to be galvanized seldom passes. By using the new technique the flux is kept active constantly at the place where the work enters and the partially or fully spent flux is automatically pushed back to prevent the formation of zinc ashes. It may be that operating conditions at the kettle may require some additions of the No. 20 Flux in the solid form but this will be at comparatively infrequent intervals and in minimum amounts, thus avoiding or reducing the losses occurring by the present methods of adding flux.

✦ ✦ ✦

IN the final analysis it will be seen therefore that by this technique we have rid ourselves first of all the dross formed by the introduction of work coated by iron salts; second, we have reduced to a minimum the alloy layer structures in the zinc coat which normally cause fracture; third, we have eliminated in almost every instance the necessity of shovelling on great quantities of fluxing materials to the top of the kettle and fourth, we have reduced two operations to one which is entirely uniform in technique.

✦ ✦ ✦

High Tension Cable Production

(*Continued from page 170*)

age would affect the dielectric favorably.

Perhaps it is known that it is assumed that this characteristic of the compound during operation is more or less inclined to improve the dielectric strength.

It is said, that the frequent changes of temperature and the circulation of the compound so forced may be a process of secretion. The unfavorable ingredients of the compound may be so separ-

ated and may settle at the nearest suitable point. If there are paper voids in the insulation, they will concentrate at that point. If there are no paper voids, they will concentrate within the conductor and so improve the quality of cable.

✦ ✦ ✦

THERE is much more that could be said about voids in the insulation due to poor workmanship on stranding, taping and cabling, but it would only lead to an endless discussion.

✦ ✦ ✦

MUCH has been done to make these voids ineffective (Hoechstaedter Patent) in the last years, but **much more also could and should be done to eliminate the root of the troubles, namely the mechanical voids in the insulation.**

✦ ✦ ✦

Die Recutting, Polishing and Finishing

(*Continued from page 171*)

fore, giving this data for use with olive oil.

✦ ✦ ✦

THE grading depends for accuracy on the maintenance of the oil at a constant temperature, usually 70° F., and care in pouring the oil off of the precipitated powder at the end of the time period. A water bath is recommended for use in maintaining a constant temperature and the use of extreme care is urged in order to keep some of the coarser particles from creeping into the oil when it is poured off of the sediment. A perforated metal disc on the end of a rod is sometimes used for this purpose. The disc closely fits the inside of the circular vessel used for holding the oil.

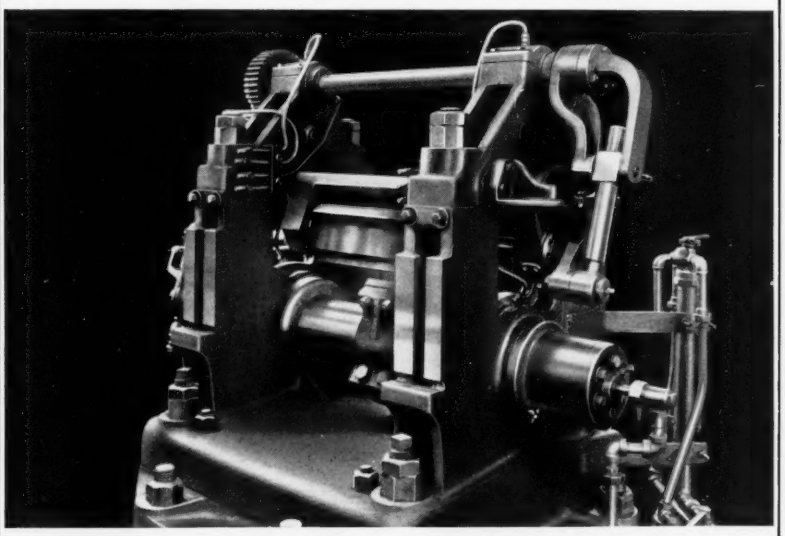
✦ ✦ ✦

AT least twenty-five carats of diamonds should be graded at one time. Fifty carats is a more economical quantity to grade as the time required is only a very little greater than is required for grading twenty-five carats. It costs nearly as much to crush and grade the powder as the diamonds cost.

✦ ✦ ✦

HAVING crushed twenty-five or fifty carats of diamonds and scraped the powder into the oil, thoroughly stir the mixture

FLYING SHEAR
by LEWIS



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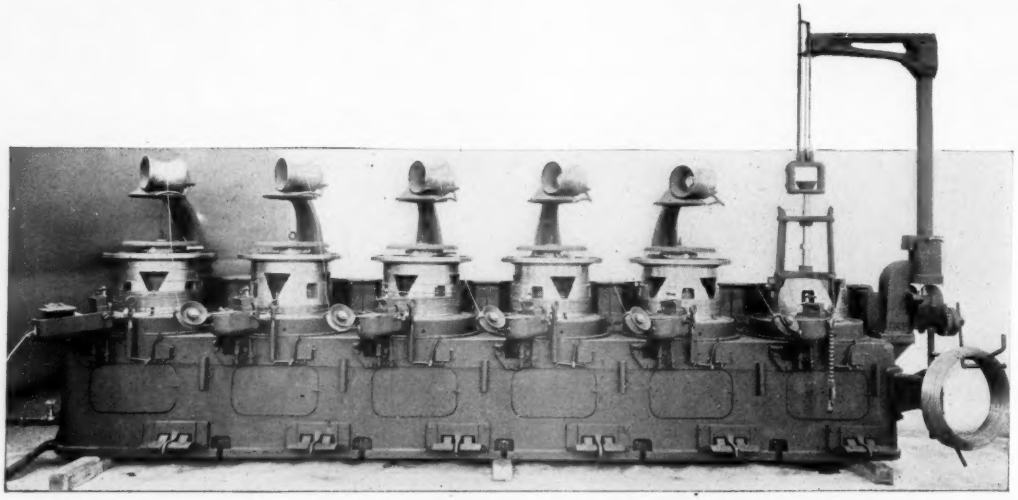

Model E A-1 for six drafts
From No. 3 Rod to 16½ AS&W gauge in one operation.

✦ ✦ ✦

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until no powder is on the bottom of the vessel. Allow the mixture to stand for five (5) minutes and then pour off into another vessel. The diamond powder will be coarse and is classified as No. 1. This grade is seldom used. It may be crushed again and graded into finer powder with the next lot. Again stir the oil until thoroughly mixed and allow this mixture to stand fifteen (15) minutes. The residue will be No. 2 powder. Pour off as before into another vessel and repeat using the following settling times:

No. 1—	**5 minutes**
No. 2—	**15 minutes**
No. 3—	**2 hours**
No. 4—	**7 hours**
No. 5—	**12 hours**
No. 6—	**24 hours**
No. 7—	**All over 24 hours**

✦ ✦ ✦

THE residue from which the oil is poured can be washed into a porcelain evaporating dish using benzine to thoroughly clean the powder from the vessel used for the precipitation. The powder can be washed quite free from oil with the benzine and then be allowed to settle so that most of the benzine can be poured off. Then add a little alcohol and mix with the powder. When this is thoroughly mixed, set fire to the mixture and burn dry. The residue is the dry powder. The powder can be placed in bottles for future use. Sometimes the powder is not dried but is cleaned of some of the oil and stored in a fluid.

✦ ✦ ✦

THE dry powder is usually again mixed with a small amount of olive oil when used for lapping. The dishes from which the powder and oil are actually used should have a V-shaped bottom for economy.

Ask About The
Wire Association

Exports And Imports of Wire

(*Continued from page 183*)

Kingdom supplied 11,659 square feet $11,845), Germany 658 square feet ($888) and Switzerland 42 square feet ($151).

✦ ✦ ✦

WIRE cloth and screening imports were one-third larger at 24,840 square feet, which figure included 15,230 square feet from Germany, 8,993 square feet from the United Kingdom, and 617 square feet from France.

✦ ✦ ✦

FOURDRINIER wire receipts were much smaller at 35,750 square feet, Germany again being the principal supplier with a total of 17,667 square feet, followed by France with 6,868 square feet, Austria with 5,739 square feet, and Sweden with 5,476 square feet.

✦ ✦ ✦

WOOD screw exports during March were as follows. Iron and steel 40715 gross valued at $6,-403—Brass 3131 gross valued at $612—Imports totaled 2027 gross valued at $377.

✦ ✦ ✦

IMPORTS of wire fencing and netting were, in the aggregate, slightly increased in March as compared with February, receipts of that galvanized before weaving totaling 4,541,000 square feet and including 3,529,250 square feet from Germany, 610,025 square feet from Belgium, and 401,825 square feet from the Netherlands, while that galvanized after weaving totaled 2,971,275 square feet and included 1,738,175 square feet from the Netherlands, 1,065,100 square feet from Germany, and 168,000 square feet from Belgium.

✦ ✦ ✦

WIRE heddle imports totaled 424,000 pieces including 266,-000 from France, 124,000 from Switzerland, and 34,000 from Germany.

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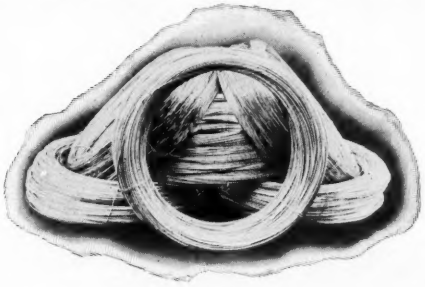
● BELL MINE PULVERIZED ●

SILVER BRIGHT GALVANIZED



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✦ ✦ ✦

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BRIGHT BASIC	TINNED	ROPE WIRE
COPPER-BEARING	COPPERED	TELEPHONE WIRE
ANNEALED	"GALVANNEALED"	SPRING WIRE
LIQUOR FINISH		WELDING RODS

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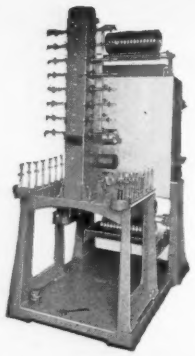

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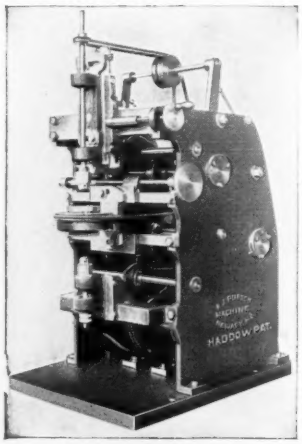

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Sheffield University Continues Wire Research

WORK of very great interest and importance on wire research is being carried out at Sheffield University under the expert supervision of Professor C. H. Desch of the research department for the cold working of steel and other ferrous metals. Work on the hardness of wire arose out of experiments in connection with the wearing properties of wire in wire ropes. So interesting and unexpected were the results that not only was a different view obtained in regard to the method by which cold work in drawing takes place, but there was opened up a new angle from which the study of the heat treatment of steel, not only for wire manufacture but for all types of hardened steel, could be approached.

✦ ✦ ✦

THE university has also been engaged in carrying out a great number of tests to determine the bending properties of wire with a view to establishing fair and just specifications for wires of all types. Work in hand embraces not only matters concerning the production of wire, strip, and bars, but even follows these products in their useful life.

✦ ✦ ✦

THE influence of different surface conditions of the wire on the fatigue strength of drawn wires has received much attention. It has been shown that grinding the hot-drawn rod before cold drawing increases the fatigue range, but removing the decarburized layer introduces unexplained hardness distributions in the wire and does not increase the fatigue range to as great an extent as might have been expected. Concurrent researches with those on wires have shown that surface marks, and especially corrosion, very seriously reduce the fatigue range of steels, while for the higher carbon steels in a high degree of polish increases the fatigue range. The best results possible at the moment are obtained from wires drawn from a rod that has been ground after hot rolling and has a polished surface.

The H. J. Ruesch Machine Company, 401-411 Mulberry Street, Newark, New Jersey, has placed on the market a new machine, manufactured under the Haddow patents, for cutting and polishing cemented carbide wire drawing dies. In making a finished die from an incased rough nib, the general present practice is to use two or three machines and polish by hand. The new single Ruesch unit will perform all of the necessary operations, eliminating all hand work.

✦ ✦ ✦

A VERTICALLY reciprocating spindle, which can be swiveled to obtain a maximum 45° inclined angle in the die, holds the straight wire or tapered rod. A revolving split collet, which can be swiveled, holds the die while being cut. The approach angle, the reduction area angle, and the bearing are cut at one setting of the die in the chuck, assuring concentricity of all diameters. Except in the case of small diameter dies, the relief angle also is cut in the same setting. All of the angles and the bearing can be cut with a straight rod or wire except in the case of very small dies, where a tapered rod is advantageous. When a tapered rod is used for cutting the various angles, one tapered rod will cut any desired angle in the die up to the 45° maximum. This revolving and oscillating tapered rod is in constant contact with the surface being cut; therefore grooves, due to wear, are impossible. These features reduce the tool costs tremendously.

✦ ✦ ✦

THIS machine gives an exceedingly high polish, so essential to long die life, perfect product, and low power consumption.

✦ ✦ ✦

THE machine is exceedingly fast cutting due to the fact that the cutting surface are in constant contact with the die; it has cut .010″ per minute using 280 Boron Carbide as the abrasive.

✦ ✦ ✦

A SHOP description of a test conducted on April 13th, 1933 is shown on page 129 of the May 1933 issue of WIRE.

The crack trains, which pay best, are trusted solely to men, who have learned from—*Experience.*

—As wire drawers for over 30 years, we know from *Experience* the particular shape of die for each material. We have found from this same experience that our special casting method of setting is best.

Why not let us quote on your diamond die requirements?

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Lynn, Massachusetts.

FRANK W. BUNN

Frank W. Bunn, general plant manager of the John A. Roebling's Sons Company, died May 2nd at Mercer Hospital, Trenton, N. J., of pneumonia, following an illness of four days. He was 68 years old.

Mr. Bunn came to Trenton in 1905 as chief engineer at the Roebling plant and served in that capacity for more than 20 years before he was appointed as plant manager.

A graduate of the University of Illinois, in his native State, Mr. Bunn began his long engineering career on the West Coast in the railroad shops at San Francisco. He was a civil engineer, and in that capacity came East to become affiliated with the Southwark Foundry and Machine Company of Philadelphia.

He left that firm to take up his activities here, as successor to John H. Janeway, chief engineer.

Mr. Bunn leaves a niece, Mrs. C. F. Rothgeb, of Harlingen, Texas, and a sister-in-law, Mrs. E. L. Doyal, of Champagne, Ill.

✦ ✦ ✦

Robertson Reminders

"Robertson Reminders" the title of a new house organ issued by the John Robertson Company, Inc., 121 Water St., Brooklyn, N. Y., manufacturers of Lead Encasing Presses, Extruding Presses, High Pressure Pumps, Accumulators, etc. This is a profusely illustrated well gotten up and interesting booklet and will be furnished to inquiries upon request.

✦ ✦ ✦

The Kay Manufacturing Co., of Brooklyn, N. Y., is now in the process of re-organization as the Kay Manufacturing Corp. The company is being returned to its original owner Mr. Lippert.

WIRE DRAWING MACHINERY AND EQUIPMENT
Rod Frames—16" Frames, 8" Frames —Take-Up Frames, Wire Pointers— Puller Tongs.
General Castings for Wire Mill use.
Circulars on Request.
E. J. Scudder Foundry & Machine Co.
Trenton, N. J.

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FOR ALL SIZES, SHAPES AND KINDS OF WIRE
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Famous Wire Drawing Diamond Dies
250 EAST 43rd ST., N. Y. CITY

BUYERS' GUIDE

For more complete information, consult the annual Directory, Index & Buyers' Guide.

ACID RESISTING PIPES AND FITTINGS
Haveg Corporation, Newark, Del.

ANNEALING FURNACES
See Furnaces—Various Headings

ANNEALING POTS AND BOXES
National Wrought Iron Annealing Box Co., Washington, Pa.
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

BAKERS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CASTINGS—Wire Mill
E. J. Scudder Foundry & Machine Co., Trenton, N. J.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.

CHROME NICKEL—Construction
National Wrought Iron Annealing Box Co., Washington, Pa.

CLEANING & PICKLING EQUIPMENT
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

COILERS—Sheet and Wire
H. J. Ruesch Machine Co., Newark, N. J.

CRANES—Wire Mill
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Composition
Vianney Wire Die Works, New York, N. Y.

DIES—Diamond
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
Vianney Wire Die Works, New York.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Corp., New York.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Vianney Wire Die Wks., N. Y.

DIES—Recutting and Repolishing Machine
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Newark, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Master Wire Die Co., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Newark, N. J.
Driver-Harris Co., Harrison, N. J.
Master Wire Die Co., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES—
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

ENGINEER—Consulting Wire Mill
Jagielski, Otto, Yonkers, N. Y.
Lewis, Kenneth B., New York, N. Y.

EYELETS—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FURNACES—Annealing
Electric Furnace Co., Salem, O.

FURNACES—Automatic
Electric Furnace Co., Salem, O.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.

FURNACES—Electric
Electric Furnace Co., Salem, O.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
John Robertson Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Electric Furnace Co., Salem, O.

GALVANIZING ENGINEER
W. H. Spowers, Jr., New York, N. Y.

FURNACES—Wire
Electric Furnace Co., Salem, O.

GALVANIZING KETTLES—
National Wrought Iron Annealing Box Co., Washington, Pa.

INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Wm. M. Parkin & Co., Pittsburgh, Pa.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LIME—Pulverized
Amer. Lime & Stone Co., Bellefonte, Pa.

LUBRICANTS—Wire Drawing
R. H. Miller Co., Homer, N. Y.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Machinery Co., Philadelphia, Pa.
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

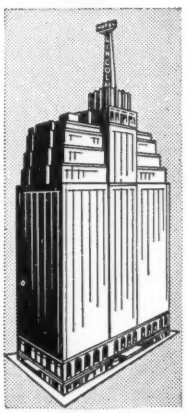
MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Coilers
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

IN THE HEART OF NEW YORK

TO STAY AT THE LINCOLN
. . . IS A HAPPY REMEMBRANCE



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UNDER NEW MANAGEMENT "A RELIANCE HOTEL"

BUYERS' GUIDE, Continued

MACHINERY—Copper Wire Drawing and Rolling
Kratos-werke Aktiengesellschaft Gruna 1. SA. Germany
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
New England Butt Co., Providence, R. I.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Measuring Wire & Cable
Lyon Measuring Machine Division of Barbour Welt ng Co., Montello, Mass.
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
H. L. Reusch Machine Co., Newark, N. J.

MACHINERY—Rubber Strip Covering
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila Pa.
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Machinery Co., Phila.
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening Hollow Wire
Fred'k M. Conran, Newark, N. J.

MACHINERY—Stranding
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Welding Wire
F. B. Shuster Co., New Haven, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Fred'k M. Conran, Newark, N. J.
Kratos-werke Aktiengesellschaft Gruna 1. SA. Germany
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

PACKING—Metallic Fibre
Hudson Wire Co., Ossining, N. Y.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PICKLING AND PLATING TANKS
Haveg Corporation, Newark, Del.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REELS AND SPOOLS—All Kinds
R. B. Hayward Co., Chicago, Ill.

REEL AND TENSION STAND—
Sleeper & Hartley Inc., Worcester, Mass.

REEL CRUTCHES
R. B. Hayward Co., Chicago, Ill.
Watson Machine Co., Paterson, N. J.

ROLLING MILLS—See Machinery—Rolling Mill

ROLLS—
Lewis F'dry & Machine Co., Pittsburgh, Pa.

SOAPS—Wire Drawing
Drakenfeld & Co., B. F., New York, N. Y.
R. H. Miller Co., Homer, N. Y.

SPOOLS—Aluminum Alloy
Lestershire Spool Co., Johnson City, N. Y.

STEEL PLATE CONSTRUCTION—
National Wrought Iron Annealing Box Co., Washington, Pa.

STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

TANKS—Compound
Haveg Corporation, Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Steel Plate
National Wrought Iron Annealing Box Co., Washington, Pa.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VULCANIZERS
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.

WIRE—Enameled For Coils
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Manufacturers
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Non Ferrous to Specification
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Steel—Also Coppered Steel—Also Glavanized Steel
Keystone Steel & Wire Co., Peoria, Ill.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

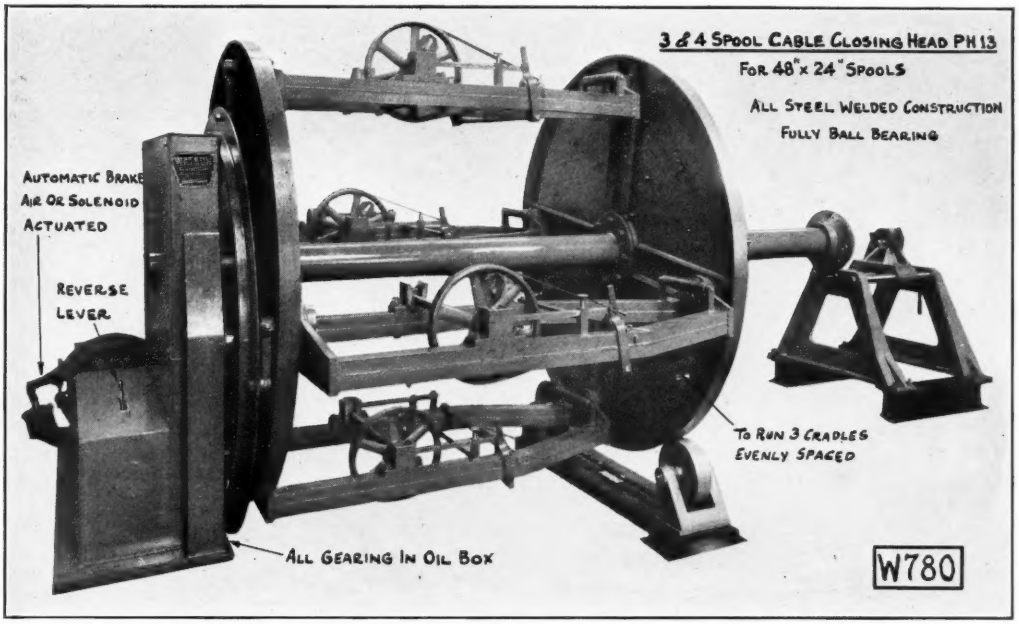
THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE—WIRE ROPE AND CORDAGE MACHINERY

Straight Line Planetary Cable Closing Heads



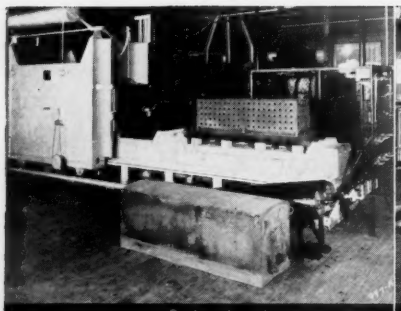
For CLOSING or CABLING, where the highest possible speeds are not demanded, we offer this All-Welded-Steel, Full Ball Bearing design, at a considerable advantage in price. All gears are cut, the entire drive being oil-encased; with brake on the head stand, operated by air or electric solenoid; or by hand if desired.

Four-Spool Heads are built so that one cradle may be removed and two others transferred quickly to give exact 3-cradle spacing.

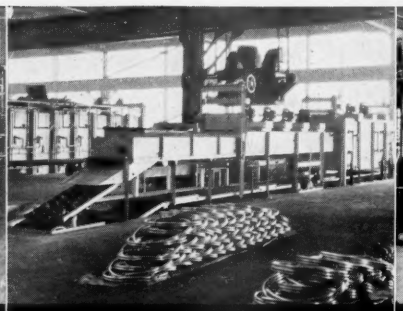
Six-Spool Heads have all cradles in one circle.

Head	PH-10	PH-11	PH-12	PH-13	PH-14
Spool Size	24" x 12"	30" x 15"	36" x 18"	48" x 24"	60" x 30"
Speeds — 4-spool head	50	45	35	25	20
Speeds — 6-spool head	45	40	31	22	18
With Unit Spool Load of	600 lbs.	1000 lbs.	1500 lbs.	3500 lbs.	5000 lbs.

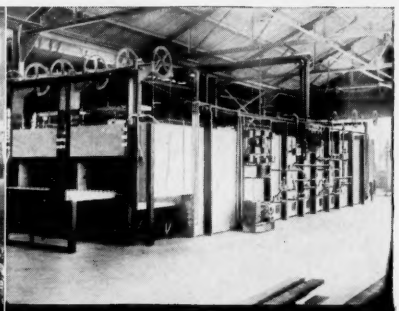
We Build the Furnace To Fit Your Job



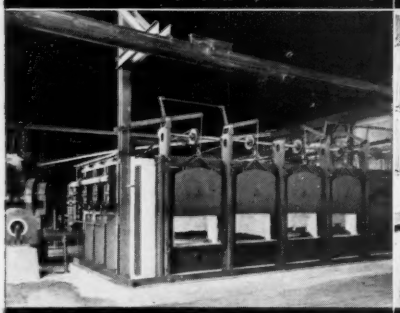
NITRIDING Batch and semi-continuous types for low-cost production nitriding



Bright Annealing Ferrous and non-ferrous clean - dry - continuous

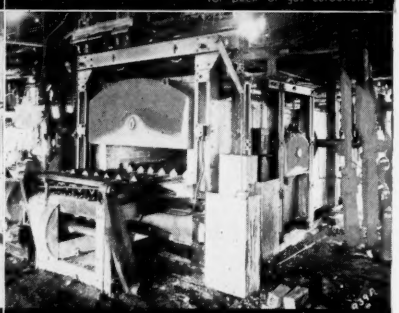


CARBURIZING Electric or fuel fired furnaces for pack or gas carburizing

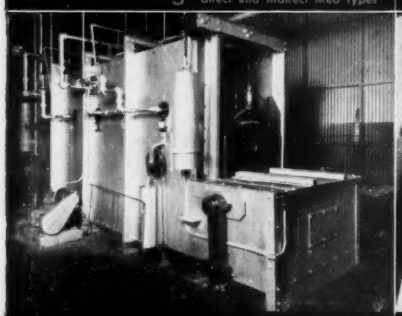


Billet Heating Oil and gas fired furnaces - - direct and indirect fired types

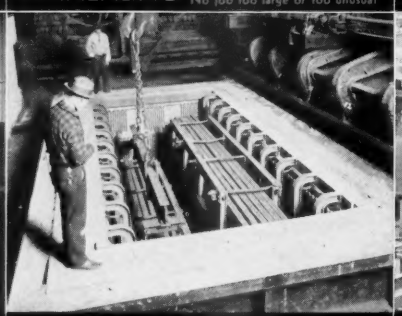
ANNEALING Oil stills up to 67 ft. in length. No job too large or too unusual



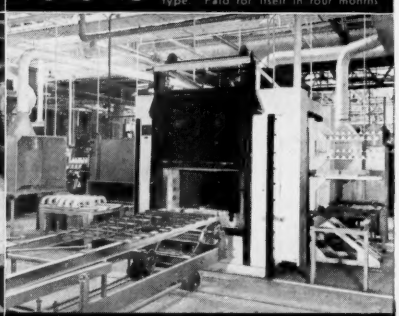
FORGING Continuous grooved hearth pusher type. Paid for itself in four months



HARDENING Chain belt furnaces for miscellaneous products - over 50 in use

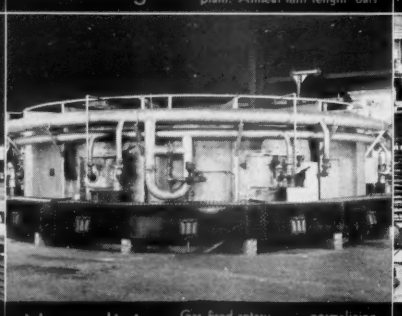


Annealing Pits One of a battery of five in one plant. Anneal mill length bars

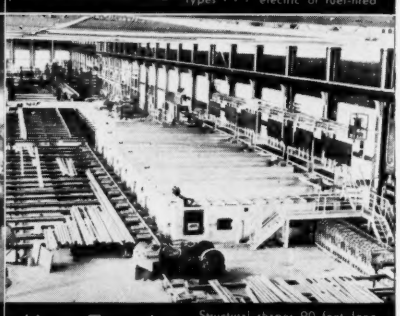


ENAMELING Furnaces in continuous and batch types - - - electric or fuel-fired

Heat Treating 32 hearth type furnaces -- capacity 450,000 lbs. per day



Normalizing Gas fired rotary - - - normalizing 6000 lbs. 96" x 36" sheets per ho



Heat Treating Structural shapes 90 feet long uniformly treated in this furnace

THE ELECTRIC FURNACE CO.

FUEL FIRED FURNACES

SALEM, OHIO.

ELECTRIC FURNACES